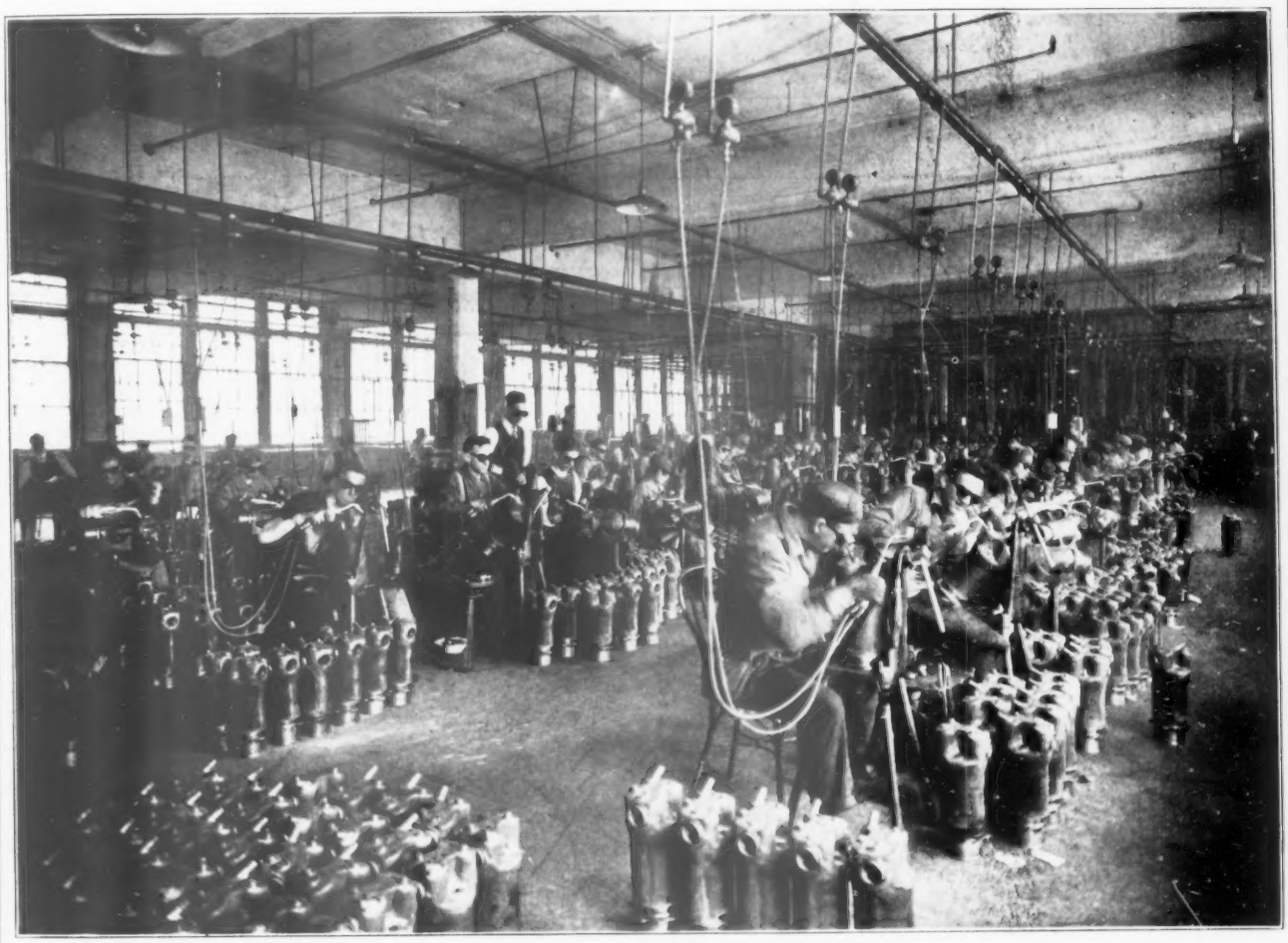
The Welding Engineer

Reg. U. S. Pat Office

Vol. III. | Chicago 608 S. Dearborn St. | DECEMBER, 1918 | $2.00 per year in U. S. $2.50 per year abroad | No. 12



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P. F. Willis

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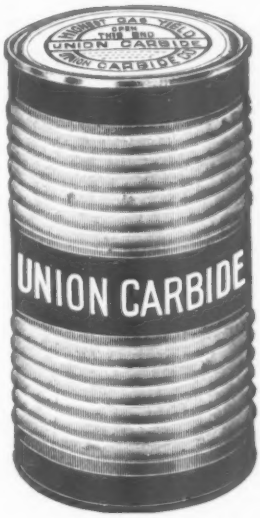

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Virginia—413 Chestnut St.
MISSISSIPPI
Vicksburg—1312 Washington St.
MISSOURI
Kansas City—1316-1318 W. Eighth St.
St. Joseph—920 S. Sixth St., Sta. "A."
St. Louis—(See East St. Louis, Ill.)
NEBRASKA
Omaha—1007-9-11 Jones St., Union Sta. P. O.
NEW JERSEY
Camden—West and Clinton Sts.
Jersey City—554-56 Henderson St.
NEW YORK
Albany—Montgomery and Colonie Sts.
Binghamton—21 Jarvis St.
Geneva—Exchange St. and Railroad Pl.
Jamaica—11 New York Ave.
Kingston—O'Neil St., near Broadway, New York.
Niagara Falls.
Poughkeepsie—Smith St. and N. Y., N. H. & H. R. R. Tracks.
Roscoe.
Utica—135 Hotel St.
Watertown—438 Court St.
Whitehall—22 Main St.
NORTH CAROLINA
Wilmington—Room 16 Masonic Temple, 13 N. Front St.
NORTH DAKOTA
Fargo—17 Broadway.
OHIO
Cincinnati—63-65 Plum St.
Cleveland—601 The Citizens' Building.
Columbus—330 Dublin Ave.
Dayton—812-828 E. First St.
Lima—338 East High St.
Toledo—414 S. Erie St.
Zanesville—Main and Second Sts.
OKLAHOMA
Oklahoma City—27-29 E. Grand Ave.
OREGON
Portland—Fifteenth and Hoyt Sts.
PENNSYLVANIA
Beaver—359 Beaver St.
Du Bois—Weber Ave. and Franklin St.
Erie—1426 Chestnut St.
E. Greensburg—Clark and George St.
Harrisburg—627 Walnut St.
Johnstown—Messenger St. & B. & O. R. R.
Pittsburgh—1202 Chamber of Commerce Building.
Pottsville—Railroad and Sanderson Sts.
Scranton—Penn Ave. and Vine St.
Shamokin—5th and Walnut Sts.
Williamsport—Canal and Court Sts.
SOUTH CAROLINA
Charleston—153 Church St.
TENNESSEE
Chattanooga—627 Volunteer State Ins. Bldg.
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Richmond—18th and Cary Sts.
WEST VIRGINIA
Bluefield—195 Roanoke St.
Charleston—Broad St. and K. & M. R. R.
Fairmont—"A" Street.
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Seattle—1103 First Ave.
Spokane—646 Peyton Building.
WISCONSIN
La Crosse—Front and King Streets.
Madison—513-19 Williamson Street.
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We recommend our customers to select from the list, the city from which the quickest delivery and lowest freight rate can be obtained, and address their orders to "Union Carbide Sales Company" at the distributing point selected accompanied by remittance.

Please address request for information or special correspondence to either the New York or Chicago office.

SAFETY FIRST

Patented July, 1916

OXY-ACETYLENE GAUGES

for

WELDING and CUTTING APPARATUS

United States Gauge Co.

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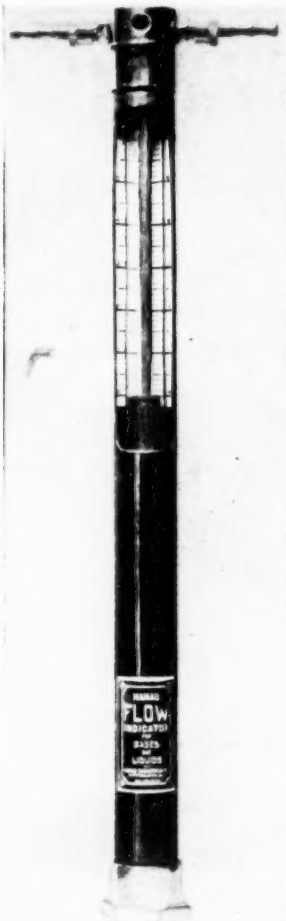


Your ***Welding*** or ***Cutting Outfit*** is ***not complete*** unless you use a

"HANAU FLOW INDICATOR"

(Patent applied for)

A **simple means** to indicate the **exact rate of consumption** of Acetylene, other combustible gases or Oxygen.

To control the **efficiency** of the different operators, or of the different makes of torches or tips.

An automatic, reliable and simple way for skilled or unskilled men **to obtain** a **desired flame,** i. e.
Correct intensity,
Correct strength,
Correct action.

RESULT:
Saving in gas, time and labor,
Better work.

Price $40 f.o.b. Pittsburgh.

Write for further information.

Hanau Engineering Company
410 Bessemer Bldg., Pittsburgh, Pa.

Welders' Goggle No. 5

The above cut represents our No. 5 Goggle. Leather body with collapsible cups. Mounted with Dark Gray Green glass, Light for Cutting, Medium dark for Welding and Extra Dark for heavy work, also furnished with Blue, Amber or Clear White glass.

Per pair $1.25
Prices in quantity upon application.

WILLIAM C. ADAMS

Manufacturer, Importer and Wholesale Dealer in
WELDING GOGGLES AND PROTECTION GLASSES
332 Boylston St., :: BOSTON, MASS., U. S. A.
Write for Catalog. *Samples Submitted*

Universal All-Steel Welding Truck

A time-saver and convenience which no progressive welding shop can afford to be without. Made in two sizes; to carry two 100 ft. drums, and to carry two 200 ft. drums.

Truck is equipped with torch hooks on which the torch can be conveniently placed when not in use, and a ten hole tip rack. The welding rod supply box is made to carry eight pounds of welding rods. The supply case, spaced off into compartments, will carry two one-pound cans of flux, cutting tips, adaptors, goggles and wrenches.

The truck has a hand wheel drum tightening device, strongly constructed, and so made that the drums are held tightly, eliminating any shaking when the truck is in motion.

The entire truck is constructed of heavy angle iron, and has a 10 gauge steel platform. It is so constructed that when fully loaded it will balance easily, facilitating rapid transportation. WRITE FOR PRICES TODAY

UNIVERSAL OXYGEN COMPANY : Sheboygan, Wisconsin

Milwaukee Branch, 554-556 E. Water St.

High Silicon Cast Iron Welding Rods

Atlas Quality

Also rods, wires and fluxes for welding all metals. Quality guaranteed.

Prices Cheerfully Quoted.

ATLAS FOUNDRY CO.
IRVINGTON, N. J.

Attention, Gas Manufacturers

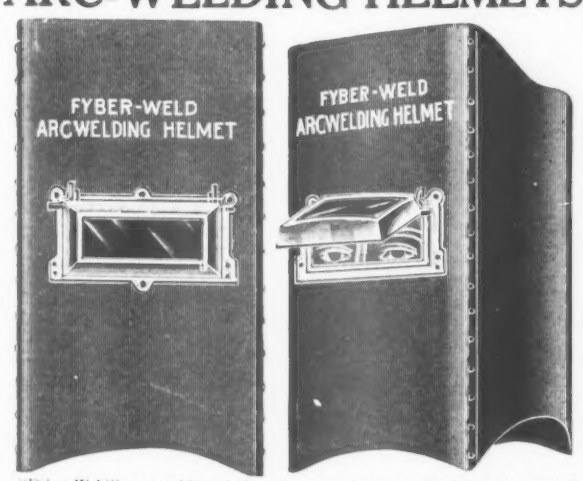
We manufacture cutting equipment for the following gases:

Acetylene, Carbo-Hydrogen, Hydrogen, Thermoline, Artificial, Rock gas and Natural gas.

Also, Welding equipment.
With your name plate attached if desired.
Our factory is the best equipped in the country for quantity orders.
No goods retailed.

Harris Calorific Co.
2828 Washington Ave. CLEVELAND, OHIO
Send for circular

"FYBER-WELD" ARC-WELDING HELMETS



"Fyber-Weld" arc-welding helmets are specially constructed under entirely new plans. The "Fyber-Weld" arc-welding helmet rests on the shoulders; it is very light; made entirely of fibre; the curve at the base makes it rest easily on the shoulders. Inserted in the front of the helmet is an aluminum frame, or door. The outer door of this frame carries the deep colored glass. On the stationary frame, which is fastened to the fibre, is the examination or Safety Lens, to prevent sparks from striking the eyes, thus doing away with and relieving the operator of the necessity of wearing a pair of spectacles. This window or examination lens is of a light tint of glass, such as amber or smoke violet. When the operator is preparing his work, he raises the window and it is held in position by a spring tension. As soon as the work is ready, he releases his window and it comes down in position, and no light can enter except through the deep colored glass. There is ample ventilation for the comfort of the operator.

"Fyber-Weld" Arc Welding Helmets with combination lenses, Ruby, Blue, Amber and Clear, $10.00 each.

"Fyber-Weld" Arc-Welding Helmets with our No. 12 "Essentialite" lenses the lenses that eliminate the ultra-violet and infra-red rays—and clear glass, $12.50 each.

Extra lenses, combination shade, $1.50 set.
Extra lenses, "Essentialite" color, 25c per square inch.

CHICAGO EYE SHIELD CO.
2300 Warren Avenue CHICAGO, ILL.

No. 8-G for Natural Gas, $6.50

Preheating Blowpipes

The two most essential points in welding are:

FIRST: The use of a proper sized oxy-acetylene flame.

SECOND: The saving of gas by preheating your work for the oxy-acetylene flame.

The first is under your control in the use of the oxy-acetylene apparatus you have selected.

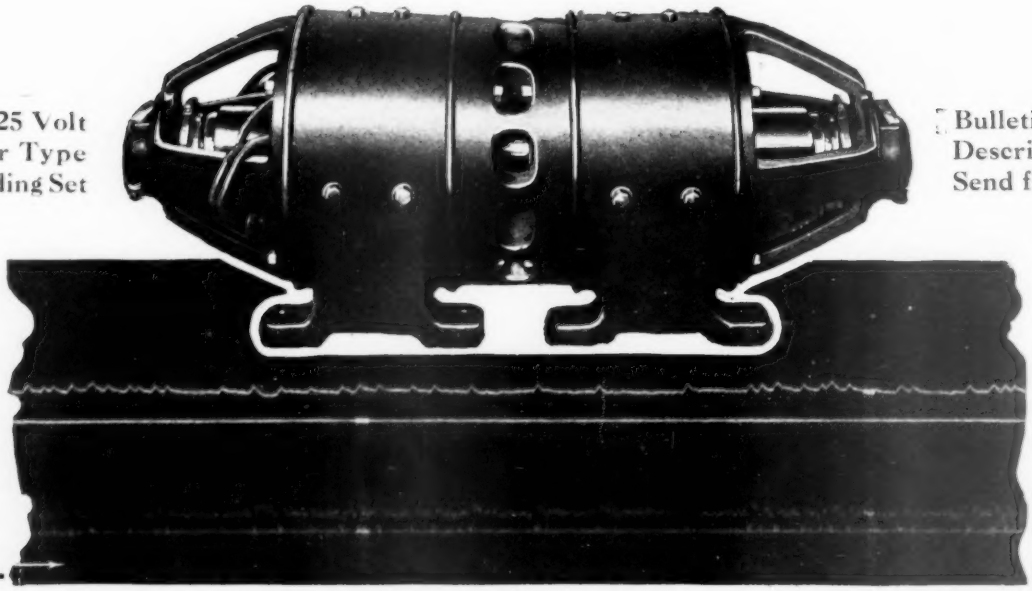
The second, we can aid you in by supplying the proper blowpipe for preheating purposes.

We manufacture blowpipes for use with Coal Gas, Natural Gas, Gasoline Gas and Acetylene Gas, with Air Blast.

Our catalog "B. X." free for the asking, contains full description and prices. WANT ONE?

Buffalo Dental Manufacturing Co.
Buffalo, N. Y., U. S. A.

3 K.W. 125 Volt
Balancer Type
Arc Welding Set



Bulletin No. 4894
Describes This Set
Send for it.

Oscillograph curve, showing electrical conditions in welding circuit of constant energy arc welding equipment. Curve "A" shows current in arc, approximate average value 150 amps. Curve "B" shows voltage across arc, approximate average value 15 volts.

Steady Flow of Metal Assured by Efficient and Simple G-E Welders

G-E constant energy arc welding sets are used to assure a steady flow of metal into the weld and high operating efficiency.

A constant flow of metal is assured by the inherent automatic regulation of the energy in the welding circuit throughout the welding range for metal electrodes.

The distribution of welding current between the two units comprising the set and practically dispensing with external resistance in series with arc, assure high efficiency.

One small panel and the set illustrated are all the equipment needed for a one man outfit where operator has mask and electrode with flexible cable—if 125 volt direct current is available.

Consistently perfect welds are being produced in essential war industries by the use of this equipment.

We are prepared to demonstrate these sets and make good deliveries.

General Electric Company

General Office Schenectady, N. Y.

WIEDERWAX MAGIC

FOUR EXAMPLES OF ASTOUNDING EFFICIENCY

No. 1 in the picture shows a cast iron engine crank pan, approximately one square foot of whose side had been punched out. Preheating preparation cost nothing. The piece was placed upon the Preheater. Four burners turned on and in thirty minutes it was ready. Cost of preheating (fuel), 10c.

No. 2 in the picture shows a cast iron valve for a coal shute, the white line along the edge showing the break. It was placed upon the Preheater and five burners turned on for one hour, the total cost being 20c. No labor in preparation, no time wasted.

The axle and bench vise shown were simply included while the other pieces were heating.

No. 3 in the picture shows a Menlo Heater to be welded as indicated by white line at the right. This piece took ten minutes to prepare, and was preheated in a little less than an hour at a cost of 40c.

No. 4 in the picture is a Ford cylinder block cracked as indicated by the white line. Preheating this type of cylinder block burns out babbits. On the Wiederwax Preheater it was heated upside down, the babbits being covered with wet asbestos, and the bores protected by a half brick to keep the flame from reaching the bearings. As a result the babbitt bearings were unharmed. The entire block was heated in twenty minutes at a total cost of 6c.

The total preheating cost for the four jobs amounted to 76c. Preparation required in total about 25 minutes. The three smaller pieces were cooled in a very few hours in the cooling oven. The Menlo heater was covered with sheet iron in order to confine the heat and protect it from draughts, and left to cool by itself, over night.

NOW COMPARE THIS WITH THE CHARCOAL AND "BURYING" METHOD

ADDRESS DEPT. X FOR FREE BOOKLET

THE GEIST MANUFACTURING CO.

2001 ATLANTIC AVENUE ATLANTIC CITY, N. J.

PRACTICAL WELDERS

WANT TO KNOW

The Cost of Operation

OF

The Mephisto A. C. Welder

If your rate is 3c per k. w. h. your cost on average work would be under 15c per hour.

Compare this with your oxy-acetylene costs.

You can't disregard a saving of this magnitude.

A portable machine with welding current from 40 to 150 amps., with a tap for intermittent cutting. No regulating apparatus or moving parts, with efficiency of over 90%.

SEND FOR BOOKLET 600

THE ARCWELL CORP.

42 BROADWAY N. Y. CITY

C. P. R. BLDG., TORONTO, CANADA

E. M. NOONAN CO.—PHILADELPHIA
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STRONG, CARLISLE & HAMMOND—CLEVELAND

LINCOLN ARC WELDER

Saves Standard Oil Co. ½ Welding Costs

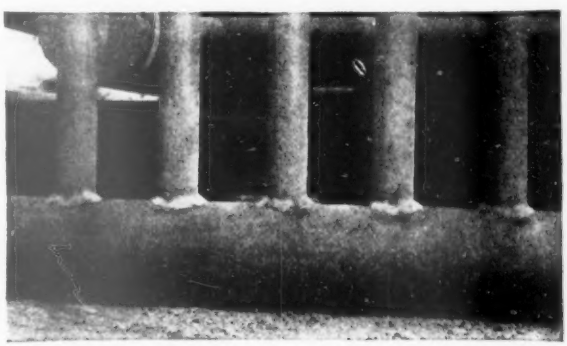
The Standard Oil Co. is saving 50% of cost by using Lincoln Arc Welders instead of acetylene for welding these radiators.

First they "made sure"—by testing carefully the merits of the two systems.

Then they "went ahead"—they are now welding radiators, oil containers and hundreds of other articles with The Lincoln Arc Welder.

Get the benefit of their experience.

Write for our Welding Bulletin No. 104-L and "make sure"—then "go ahead" and install a Lincoln Arc Welder.



A radiator welded by the Standard Oil Co. of Indiana. Comparative costs by Acetylene and Arc Welding were as follows:

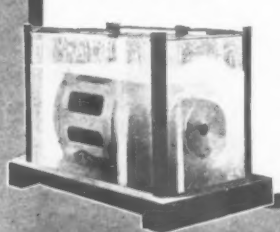
Cost of Acetylene Weld on Radiators

40 cu. ft. acetylene at	$.01	$.40
48 cu. ft. oxygen at	.016	.768
2 hrs. time at	.45	.90
		$2.068

Cost of same with Electric Weld

16.6 K. W. H. at	$ .006 per K. W. H.	$ .10
2 hrs. time at	.45 per hr.	.90
		$1.00

Operated under water over 3 years without damage.



The Lincoln Electric Co., Cleveland, O.

New York City	Boston	Columbus	Philadelphia
Buffalo	Chicago	Pittsburgh	Charlotte, N. C.
Syracuse	Detroit	Minneapolis	Toronto, Canada
			Montreal

Agencies in other principal cities

Where ARMCO IRON WELDING RODS are given a critical test

This picture shows how the K-G Welding Co. of New York utilizes ARMCO IRON filler rods in welding outlet tubes onto dished heads. After completion, the welds are subjected to 600 pounds hydrostatic pressure for half an hour and under this test the welds must be free from leakage.

We are advised by the K-G Co., who are making 10,000 of these heads, that ARMCO IRON is doing its work in a very satisfactory manner.

ARMCO IRON filler rods are the logical choice for oxy-acetylene or electric welding for many reasons. The uniform purity and metal structure assure a smooth even flow and thorough strength uniformity of the properly executed weld. This strength can be made consistent with any requirements by judicious thickness and location of the deposited metal.

Remember too that by making *a single composition* in *two tempers* to do well what has heretofore required a choice of one from many grades, ARMCO IRON welding rods effect big economies in the amount of stock that must be carried by a welding shop, and greatly simplify the whole scheme of welding.

Carried in stock by conveniently located representatives in all large industrial centers.

PAGE STEEL & WIRE CO.

Established 1883 as Page Woven Wire Fence Co.

Makers of "Copperweld" Copper Clad Steel Wire; ARMCO IRON Welding Rods and Electrical Wire; Wire Mill Products, Plain and Galvanized; Wire of Special Analysis; Wire Fencing for all Purposes; Factory Gates; Ornamental Iron Fence; Machine Guards; Tool and Stockroom Partitions; Architectural Iron.

Plants: Monessen, Pa., and Adrian, Mich.

Sales Offices: 30 Church Street, New York

Western Representatives: Steel Sales Corporation, Chicago

29

AMERICAN ARMCO INGOT IRON

The trade mark ARMCO carries the assurance that iron bearing that mark is manufactured by the American Rolling Mill Company with the skill, intelligence and fidelity associated with its products, and hence can be depended upon to possess in the highest degree the merit claimed for it.

We Can Save You Money

ON

GAS AND OXYGEN

USE

WELD-A-CAST
(Trade Mark)
FLUXES

"Weld-a-cast" is a scientific combination of chemicals, that causes the metal to melt rapidly, shortening the operation, thus economizing in time, gas and oxygen.

"Weld-a-cast" adheres readily to the hot welding rod which picks up just enough and none is wasted; it does not blow away but melts at once; it eliminates blow holes and leaves the metal soft.

Write For Free Samples

CORTLAND WELDING COMPOUND CO.
CORTLAND, N. Y.

Welding Pincers

Use up the short pieces of Welding Metal

This pincer enables the welder to use up his strips of metal almost to the end, all the time keeping his hand a good distance from the heat.

The handle is always cool, no matter how short is the piece of welding metal.

The time saved in welding the strips together quickly pays for the pincers.

Pressing the spring handle releases the jaws to pick up the metal. Length of pincers, 19 inches. Holds rods of 3-16-inch to ½-inch diameter.

Price $1.00

One sent to the address of any welding shop for 30 days' trial, on receipt of $1.00. If not satisfied money will be refunded on return of pincers.

Jobbers and Agents, write

C. SORENSEN

18 E. 16th St. CHICAGO

Aluminum and Cast Iron Flux

N Aluminum break when melted does not flow together as other metals do, but the edges creep away from each other. There is a film on the surface, dull grey in color. This film is **ALUMINUM OXIDE.** It must be destroyed before your weld can be a success. By using **RED DIAMOND** Aluminum Welding Flux the aluminum oxide is instantly destroyed and the metal assumes a bright silvery appearance. By adding **RED DIAMOND** Flux with the hot welding rod, in the usual way, not only does the aluminum oxide disappear, but dirt and grease as well.

A trial can of **RED DIAMOND** Aluminum Welding Flux will convince you that this is the flux you have been waiting for. Put up in 2 pound cans, $3.00 per can.

The best insurance a welder can have that his welds will be sound and free from craters or blow holes is to use a good flux, made scientifically by chemists who understand the needs of the welder.

The object of a cast iron flux, or in fact any flux, is to eliminate the **OXIDE** and other impurities which form on the surface of the weld, caused by the heat and combination with oxygen of the air. The reactions are the same as in a blast furnace or cupola and flux is used to **CARRY OFF THE SLAG.**

BLACK DIAMOND Cast Iron Flux, when dropped on the molten surface of the weld, instantly clears the metal of iron oxide and other foreign substances, leaving a clear, mirror-like surface, which enables the metal to run together. This condition makes a sound weld.

A very small amount of **BLACK DIAMOND** Cast Iron Flux is required to assure a good weld. The price is a secondary consideration—it's the quality that counts. Put up in 2 pound cans, $1.00 per can.

Chicago Welding Compound Co.

Transportation Bldg. Chicago, Ill.

Our Service Department is at your service.
Consult us about your flux troubles.

Swift Oxygen

For Welding and Cutting

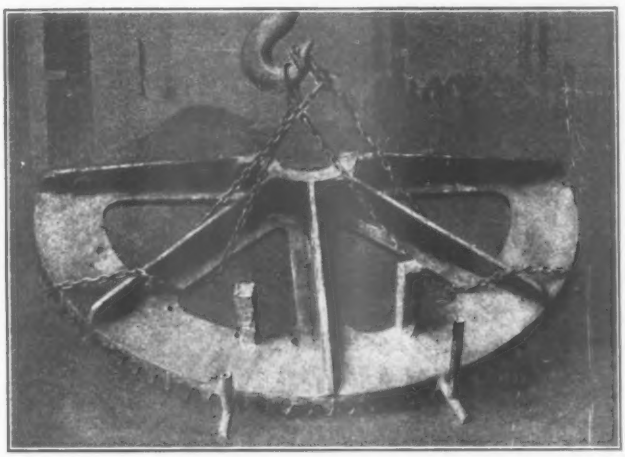
Unsurpassed for Quality

Pure Oxygen Electrolytically Made under the direct supervision of our Chemical Laboratory. It is carefully controlled by chemical analysis, thus insuring the highest obtainable purity.

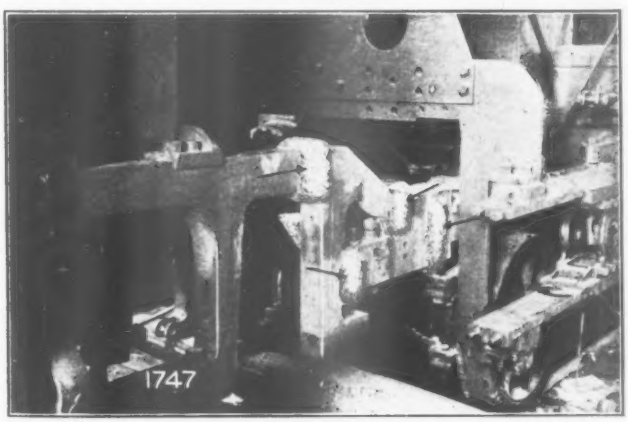
Swift & Company

Oxygen Department **Union Stock Yards, Chicago, Ill.**

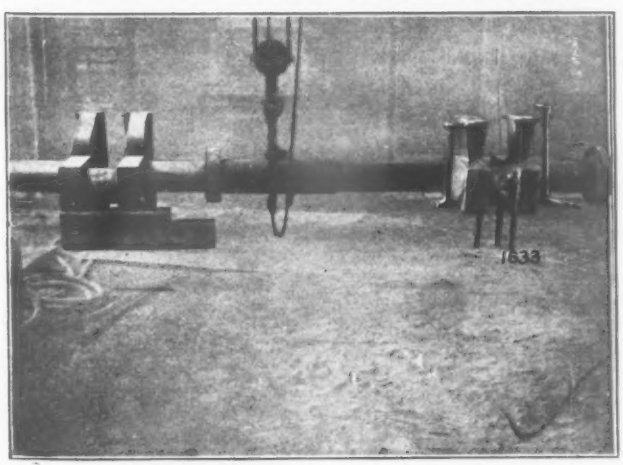
New neck cast on to large roll made with the aid of Thermit and having the pods cast in at the same time.



Large bevel gear on which two new teeth and crack have been repaired.



Four Thermit welds on locomotive frame on the Missouri Pacific Railroad, made without removing the frame from place.



New crank pin welded in by the Thermit Process.

THERMIT

The Only Reliable Process for Welding Heavy Sections

THIS Explains Why Railroads and Steel Mills Used Over One Million Pounds of Thermit in 1917. Also Why 95% of the Railroads in the United States and Canada Having Over 10 Locomotives, Use Thermit for Welding Frames and All Heavy Sections.

There are few machine parts which are subjected to greater strains or more severe shocks than a locomotive frame or a blooming mill pinion. Yet Thermit welds on such parts are being made every day and STAND UP IN SERVICE FOR YEARS. The reason for this is that, unlike ANY OTHER WELDING PROCESS, the steel to make a Thermit weld is produced IN BULK at a temperature of 5000° F. Furthermore, results are not dependent on the individual skill of the operator.

We have ample proof for all our claims and our long list of satisfied customers who come back week after week, month after month, and year after year for MORE THERMIT is a never ending testimonial to the efficiency of the Thermit Process.

Remember that Thermit should not be confused with either oxy-acetylene or electric welding. It stands in a class by itself. It welds sections which cannot be successfully welded by any other method.

Let us tell you more about it. Write for pamphlet No. 1779.

* * * *

Metal and Thermit Corporation

(Successors to Goldschmidt Detinning and Goldschmidt Thermit Co.)

The Equitable Building
120 Broadway, New York

7300 So. Chicago Ave., Chicago
329-333 Folsom St., San Francisco
1427 Western Ave., Pittsburgh
15 Emily St., W., Toronto, Ont.

BURDETT OXYGEN COMPANY

AND ASSOCIATED COMPANIES

ELECTROLYTIC OXYGEN and HYDROGEN - 99 1/2 % Pure

Service from the following BURDETT PLANTS

Seattle, Wash.
Los Angeles, Cal.
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Oklahoma City, Oklahoma
Fort Worth, Texas
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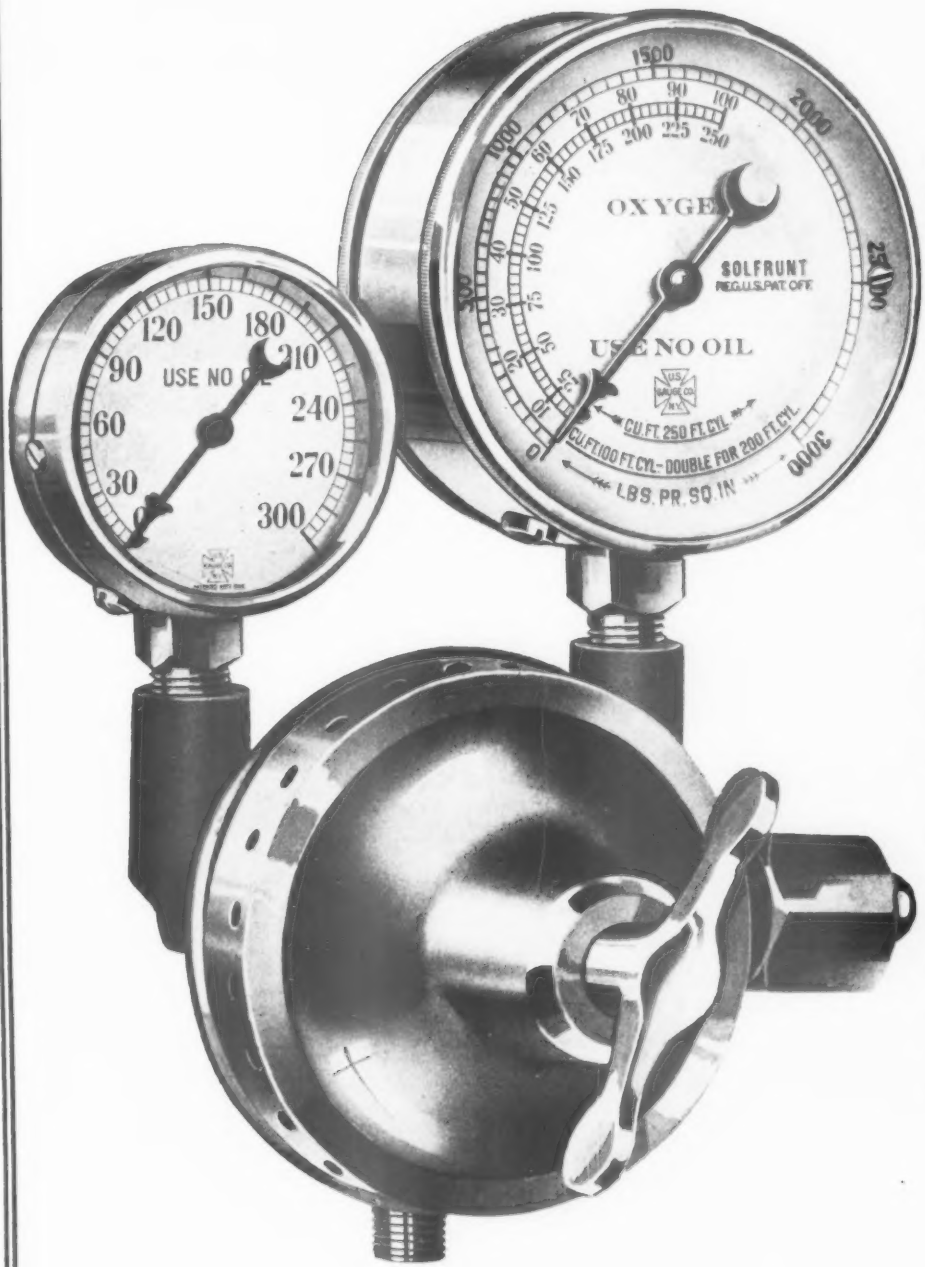
Logansport, Ind.
Chattanooga, Tenn.
Cincinnati, Ohio
Pittsburgh, Pa.
Chester, Pa.
Norristown, Pa.
Cleveland, Ohio
Chicago, Illinois

The Largest Producers of the Purest Oxygen in the World

New crank pin welded in by the Thermit Process.

Apparatus for Particular Welders



FEDERAL HIGH PRESSURE gas specialties for Oxygen, Hydrogen and Acetylene Gases are made by high grade workmen, in a high grade plant, of the best materials, for welders who know the value of and appreciate dependable regulators.

FEDERAL regulators are absolutely the best that human ability can produce, they are absolutely safe and guaranteed to give entire satisfaction.

Manufacturers of welding apparatus and users of regulators should have our descriptive bulletin.

Federal Brass Works

31st St. and Kedzie Ave. Chicago

SPECIAL NOTICE TO USERS OF OXYGEN

THE requirements for Government work make it imperative that every Linde cylinder be emptied and returned immediately.

Orders should be issued to everyone in your employ having to do with cylinders, emphasizing the importance of this.

Oxygen deliveries under present conditions will be largely regulated by the rapidity with which cylinders are emptied and returned.

THE LINDE AIR PRODUCTS CO.

The Largest Producers of Oxygen in the World

42nd STREET BUILDING

NEW YORK

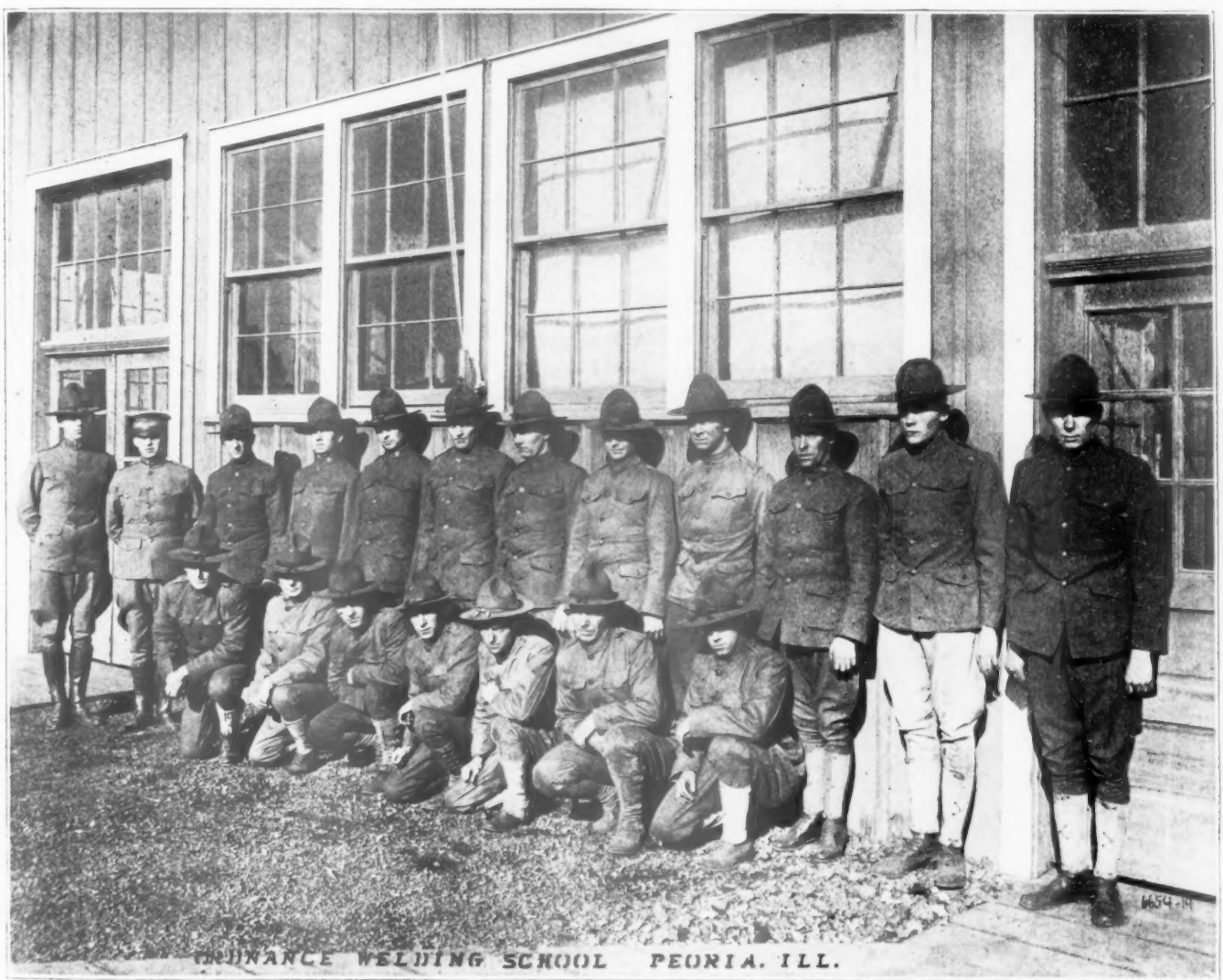
304

TRAINING WELDERS

By Lieut. Lorn Campbell, Jr., U. S. A.

Officer in Charge of Welding, Ordance Welding School, U. S. A.

There seems to be divers opinions as to the method, time and facilities necessary for the training of welders, both with the oxy-acetylene and electric arc processes. It seems strange indeed, that this country should be so far behind in such an important industry as this. It is true that some of the large manufacturers of welding apparatus and a few of the larger users have recommended, or attempted, the establishment of institutions where welding might be taught in a systematic manner, but this is as far as the matter has progressed in this country.



STAFF OF INSTRUCTORS AND ASSISTANTS AT THE ORDNANCE WELDING SCHOOL, U. S. ARMY.
(Lieutenants L. Campbell, Jr., and C. K. Rickel, Commissioned officers in charge of this school may be seen at the left of this picture.)

We all are of the opinion that welding is yet in its infancy for its first introduction in the commercial world only dates from 1906 or 1907. Its growth has been remarkable, despite the fact that it has been handicapped and has been continually discouraged by ignorant and faulty applications. Let us turn for a moment to one of the European countries that fully appreciated welding in its truth worth. Germany in 1911 recognized the wonderful achievement of Theodore Kautney and placed him in charge of the first government school of welding at Cologne. Two years later, with the assistance of his government, Mr. Kautney had established more than sixteen courses of welding at various institutions in the German empire, and we are advised that shortly before the war, very close to one hundred such schools were training welders in the oxy-acetylene art, in connection with other mechanical courses.

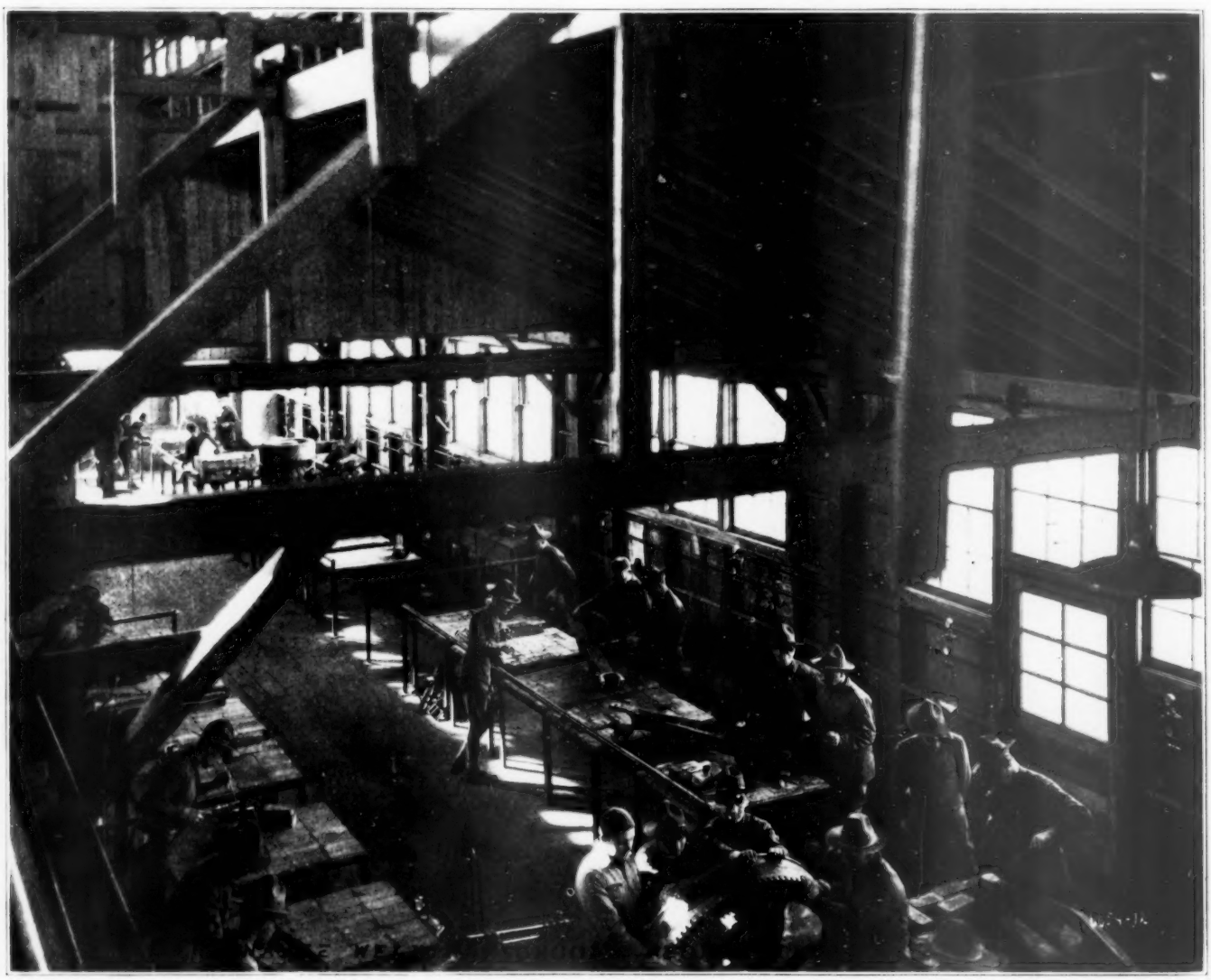
Both England and France have established government welding schools and it is therefore quite surprising, that in so vast and progressive a country as this, that no unified effort has been made by the various interests, to establish institutions of this kind. It can not be said that there is not a demand for such. The demand for welders has always been far in excess of the supply, and the wages paid have always been very attractive.

When the United States entered the war, the engineers of the War Department, recognized the importance of the welding process and placed thousands of welding apparatus in the field, on its Mobile Repair Units, and at all its base

depots, and at once began to search for welders to handle this apparatus. Almost simultaneously, the manufacturing world awoke to the great possibilities embodied in the modern fusing process and metal workers who had never given welding more than a passing glance, commenced to use it on a scale that had never been heard of theretofore. To illustrate the last point, it may be cited where one manufacturer, who previous to the war had been using only three or four welding units, had on the day the armistice was signed, over five hundred such welding apparatus in use at his factory. It is therefore not strange to know that the U. S. Army had

heap; but consisted of large and small work; finely machined, and in the rough, which, after welding, had to be scrutinized and passed by the ever viligent eye of the U. S. ordnance inspectors. It was not known when one of these welds were to be sawed or broken in two, or tested in other ways only known to the inspectors, so a very high standard had to be set.

As was true of the material upon which the welders worked, the students who were graduated as welders, were also subject to tests, and it was not known which of these were to be chosen by the departments. It is known however



AN EVERY DAY SCENE AT THE ORDNANCE WELDING SCHOOL.

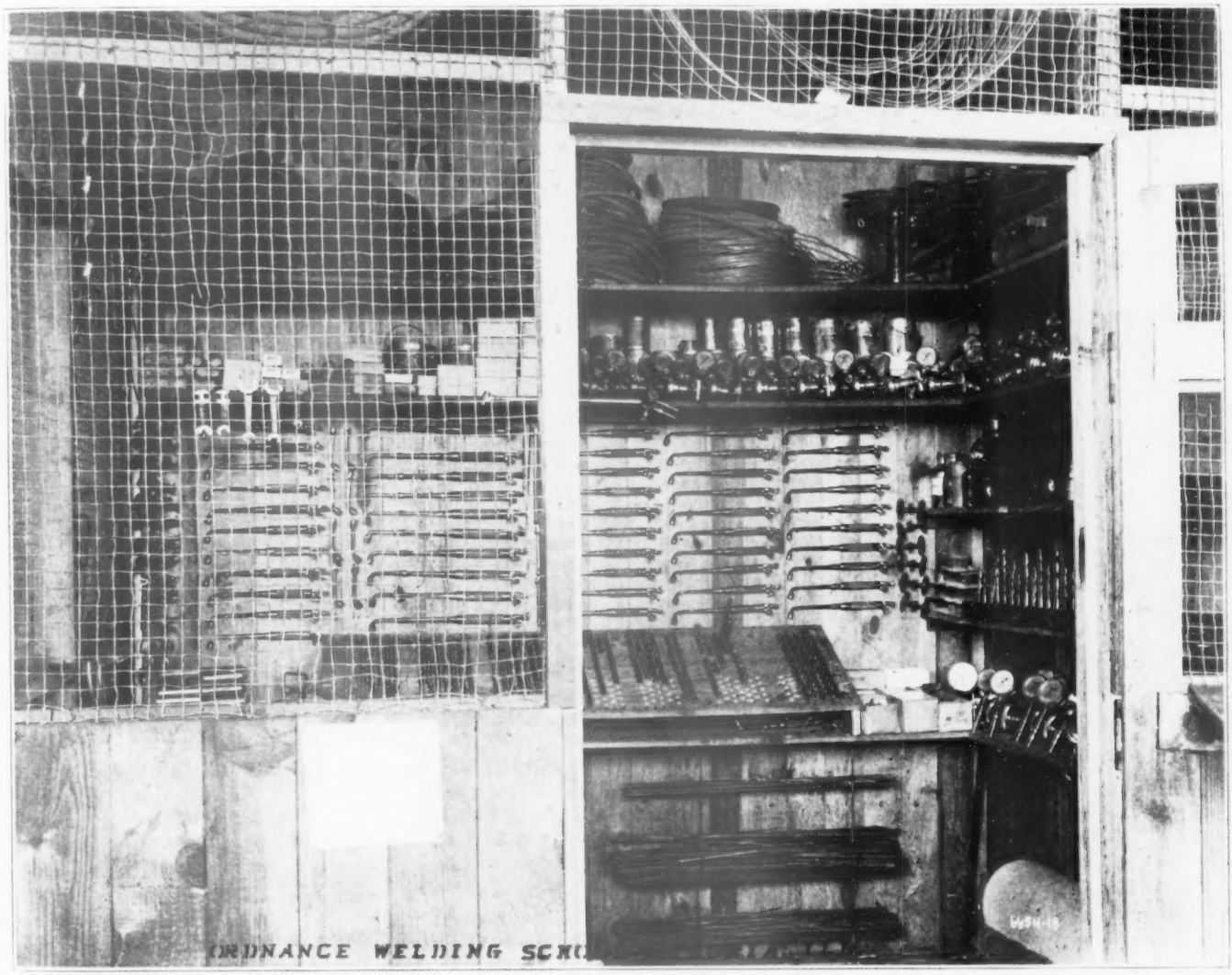
The welding tables are so constructed that two or more may be placed together, thus giving as large a surface as desired. Two temporary preheating ovens housing work may be seen on the farthermost tables.

difficulty in finding welders, for its various departments, in view of the fact that welders were scarce, and that premiums were paid for their services even before the war.

The army then did what the commercial welding world had been thinking of doing for a number of years. It started its own welding schools, where training of an intensified nature was given under trained instructors. These men who received the training were not only capable of operating a welding torch when they finished their training, but were taught to think for themselves, much more than can be said of the average welder to be found in the industrial world. The actual work upon which these men received their instruction, was not a lot of scrap metal into which valuable time and gas were thrown and later, again added to the scrap

that one particular corps of the army sent a number of its men to receive training along with other regular classes at one of the ordnance welding schools in February, 1918, and that after these men had received their instruction of thirty days and were returned to their station, that upon trial, their efforts so pleased the officers in command, that in May another body of men were sent which in August was followed by a third and much larger class. Results are the true index as to the success, or failure of any enterprise, and generally repeat orders signify success. Hundreds of men have been trained as welders at one of these ordnance schools alone, and while every man who received training did not prove to be an efficient welder, yet the majority knew how to fuse their metals in a most thorough manner.

Three very important factors must be considered in giving instruction in oxy-acetylene welding, the first of which is the cost of the gases and the welding materials. Oxygen and acetylene gas are not low priced. A cylinder containing 200 cu. ft. of oxygen and an acetylene tank with 300 cu. ft. of gas will cost on an average, around $12.00 or more, after transportation and handling expenses are considered. Is it possible to learn welding with only one such set up? It is not. At least 5 or 6 times as much gas must be consumed by the average student before a good foundation has been laid. When the cost of cast iron, steel, bronze and aluminum



STOCK ROOM, ORDNANCE WELDING SCHOOL.
A check system is employed in issuing every article. In this manner each student's use of tips, etc., is kept on file.

"filler-rods," fluxes, goggles, charcoal, kerosene, asbestos paper and the like are considered, the total will average, at the very least, $100.00 per student. It must be remembered that overhead expenses, such as rent, heat, light, power, water, depreciation of apparatus, not to mention metals being worked upon and salaries of instructors have not been included in the above. The last named list will vary to a large extent according to the location and size of the classes.

The second consideration is the subject matter for instruction. There have been several courses outlined wherein the student was to execute 50 or 60 problems in divers metals. One of these courses consisted in the main of handling 14 or 16 gauge sheet metal or perhaps a little heavier. The reason for this was probably to keep down the gas consumption. While a certain kind of welder was produced; by no means could the term "general welder" be applied of a graduate of such a course. Another, and it might be added, a very cleverly designed course had practical problems for the subject matter. Broken cylinder blocks, crank cases, sheet metal work, and some very heavy work including a shear arm casting weighing no less than 2 or 3 tons were included in this course. Such a course would almost be ideal if such material were available but to instruct for example a class numbering 100, five or six thousand pieces of work would have to be assembled and hundreds of cylinder blocks, and large numbers of shear arms, are not easily obtained.

Last, but by no means least, is the instructor. Many people are of the opinion that as long as a man is a proficient welder that he will necessarily qualify as an instructor. Such is very seldom the case. At the present time in this country, by far the largest percentage of the welders have educated themselves at this art, perhaps because they had no other alternative. Many handle the welding flame in a fairly intelligent manner, but there are few indeed, who are capable of teaching their methods to others; of telling the "Whys" and "Wherefores" of each procedure; know their apparatus intimately enough to make the student welder appreciate and respect his working tools, and at the same time possess the human interest that is essential for success.

How then, is the best method of handling these issues? It is to answer the many inquirers and assist those who are engaged in instructing welders that the methods used at the

Ordnance Welding School, U. S. Army, of handling these considerations are here outlined.

To use gas sparingly is out of the question. It would be like making chauffeurs without using gasoline. So much gas MUST be used by the welder in laying his foundation and if he does not use it during his schooling, he will, after he leaves. Of course, wastefulness must be eliminated and every foot of gas must be made to count, and there are different methods of going about this. But so far as the actual consumption of gas is concerned, a skimping will mean the student suffers. Realizing this, means were taken to turn as much of this gas, which in a certain sense might be termed a loss, into profit. This was made very easy by the usual shortage of skilled welding labor. A prominent manufacturer was willing to supply the gas and welding materials, together with buildings in exchange for the service rendered. This arrangement was so satisfactory that hundreds of welders were trained for the U. S. Army without cost to the government.

To use specific problems throughout a welding course if the classes are of any size cannot be considered, as it would require the services of a corp of men to do nothing else than to locate and prepare these problems for the course. Much of the success of the army course is attributed to the general rules outlined and the channels of thought along which each student is lead. Every man must think for himself. No operator can depend upon his fellow operator assisting him because it is seldom they work on the same job. There is an instructor for every five tables and he is held responsible for the advancement of his men. Certain points are pointed out to the student as he progresses in the shop as well as during the lectures and study hours which follow each evening.

The lot of the instructor is truly not an easy one for in addition to the instruction work, he must see that his assistant checks up the gas consumed, the cost of each job finished in his section, and keep all his apparatus correctly checked at the stock room. He must collect and correct daily all lecture reports and forward them to the chief instructor together with his notations on the same. Such men are not found—they must be made.

A word might be said about the course of instruction itself. As oxy-acetylene welding is a fusing process applied to metals, most of the student's time, during his course is naturely devoted to work in the shop. The course is started by a general lecture on the subject of welding, where the various processes are described, their application and the possibilities attached to the art as a whole. This lecture is followed by further instructions in the shop, where the apparatus, working principles, general rules of the shops and other matters are discussed by each of the assistant instructors. It has been found that an instructor is necessary for every ten students. Lockers are assigned, stockroom checks are issued and various other affairs are taken up. The students are then taught the adjustment of their flames for welding and drills are given to make each man familiar with the handling of his torch and apparatus. On the afternoon of the first day, the student does his first welding, which consists in fusing 14 or 16 gauge sheet metal, without "filler-rod," to have him become acquainted with the handling of his apparatus as a whole. In the evening, following mess, a lecture is given which reviews the work of the day and takes up a little in advance. At the conclusion of this talk, the student is required to write up certain question sheets which have been issued to him at the conclusion of the lecture. There are instructors present during this study hour, as it is called, to assist those who need it. It has been found that students, like many customers who have the opportunity of looking on when a piece is being welded, state "Why that's easy, I can do that myself." Upon examination, however, quite the opposite exists. In writing up their work, the instructors can see at once whether the student has gained the knowledge desired, or whether the lecturer has made his points clear.

The second day of the course is continued where the first left off. "Filler-rod" is used in fusing the sheet metal together. The size of these pieces are about 2″ by 6″. The third day, the student having learned how to operate his apparatus and handle his flame, work on cast iron is started. As the fusion of the metal is the most important item, test bars of cast iron, which have been numbered with the student's number, are issued, with instructions to weld from one side only. In order to handle a large number of men and give them all the same opportunity, patterns of test bars, already "V"eed out, are cast at a foundry, and these bars, measuring 2½″ by 6″ by ½″, are all the same, similar "filler-rods" are used and the apparatus employed is alike, so that each student has the same material to work with in making these test welds. Each weld, as soon as cold, is required to be broken through the weld and passed in for inspection. Here the student learns his faults and how to overcome them. He then continues making test welds until he can show a perfect cross-section of his weld, after which he is placed on commercial work, where he learns other points in relation to take metal.

Work thus progresses on cast iron, steel, brass, malleable iron, aluminum, etc., using test bars of each metal, followed by larger and more difficult work which is carefully followed in the lectures which occur every evening of the course. A text book is used as a reference and one of these is issued to each student taking the course. Mechanics and metal workers who have had no previous experience with the blacksmith forge, have shown greater ability to absorb this training than any others.

With the cessation of hostilities and the establishment of permanent welding schools by the U. S. Army, would it not be advisable for these manufacturers interested in the welfare of the oxy-acetylene welding industry to give some of their time and attention to the training of efficient operators who will do more to expand this wonderful process than all the engineers and others put together. Its the results that form the stepping stones to success and the actual operators of the torch are the ones to be educated so that their efforts will demonstrate the possibilities of this process and assist it in its growth.

In order to obtain the greatest efficiency in any industrial undertaking, good tools must be employed. The same applies to oxy-acetylene welding as the rest, and those engaged in this trade, are fully convinced that perhaps even greater care must be exercised in the choice of oxy-acetylene apparatus than in most of the other equipments used in the various industries. This point is certainly true of a training institution. For the student conditions must be as ideal as possible, especially so, if the course is to be intensified. When a "neutral' flame has been adjusted once it is not desirable to have this flame change continually, forcing the operator to stop his welding for further flame adjustments. This state of affairs is generally in evidence, unless reliable apparatus is employed. The mixing principles of the torch must be such that any desired flame may be found and remain "placed" while welding under ordinary conditions. The regulators, too, must be dependable. Unless they pass a fixed amount of gas and maintain a uniform pressure, they are not performing their function, and good welding cannot be expected. The regulators are just as important as the torch.

The equipment used can make a success or a failure of any business, therefore, considerable attention should be given to such installations, whether it be in a commercial shop or a training station for beginners.

It is understood that one of the largest makers of apparatus, now operating a job welding shop in Chicago, is planning to erect a new and modern building to house both their job shop and sales department in Chicago.

Generous thanks and due credit are to be given the following manufacturers of welding apparatus in assisting the officers in charge to make these schools a success: The Alexander Milburn Co., the Oxweld Acetylene Co., the Torchweld Equipment Co., and the United States Welding Co. Apparatus supplied by these companies have played an important part in giving the students a much broader knowledge of the various equipments than would have been possible with only one type.

The annual meeting of the Gas Products Association, which is made up of makers of Electrolytic Oxygen, will be held in Chicago about January 20th, 1919. Mr. C. E. Phillips, 29 S. La Salle St., is secretary-treasurer.

THE EMPLOYMENT OF WOMEN IN ACETYLENE WELDING. (2)

Extracts from a Report on the Activities of Women in the Welding Field During the War.

By Helen G. Fisk. (1)

Women entered the welding field at a time when it was being rapidly enlarged and changed by the necessities of war production. The manufacturers' problem included not only the adjustment of the process to a new class of labor but also changing welding method and equipment to fit them into separate stages of a continued process of manufacture.

The great need for conservation of metal has made it necessary and profitable to repair much broken machinery which would have been scrapped heretofore. The demand for good welders, always greater than the supply, has been enormously increased. Probably 1,400 welders were engaged in salvage work alone behind the line of Pershing's forces in France, a larger number was needed for repair work in this country, and still others were required to carry on welding processes in the couse of manufacture of ships, airplanes, and munitions.

Extent and Character of Women's Work.

As was the case in many other occupations, the increased demand was met in this country as well as in England and France, by the introduction of women into the industry. The need for an extra supply of welders was recognized in England early in the war and small welding courses for women were immediately instituted with decided success. Two hundred twenty were trained and placed in the first year, and the welding courses in many of the technical schools are now open to women. English women have done all types of welding with marked success.

(1) *Special Investigator for the Women's Branch, Industrial Service Section, Chicago District Ordnance Office.*

(2) *This bulletin was prepared by the Women's Branch of the Industrial Service Section of the Ordnance Department. Inspections were made in the plants of Ordnance contractors employing women for this work. A member of the staff in the Chicago District learned the welding operation on the regular production of Mark V demolition drop bombs in the summer of 1918. Questionnaires were sent to companies known to be employing women, in November, 1918, requesting information as to numbers employed, wages, and hours. A total of 894 women welders was reported from 26 companies. Leading welding authorities were consulted regarding training and the scope of women's work and the makers of welding apparatus and the National Board of Fire Underwriters, regarding hazards.*

In the United States women welders have not been given as many or as difficult types of work as have the English women, but their field of work has nevertheless been varied.

It is the concensus of opinion that women have been most successful in the lighter grades of work, such as are centered in the airplane manufacturing around Detroit. A welding engineer says in comment on this work:

"They are rendering excellent service, and by reason of their greater dexterity in handling small work, they have opened for themselves and their sex a permanent field."

On the other hand it is agreed that work from which very heavy lifting cannot be eliminated is unsuitable for women.

The estimates of welding authorities place the number of women welders in this country at from 1,000 to 1,500 or more. Very few of these are sufficiently skilled to do general high-class welding repair work. Neither has it been considered advisable to employ women for very large work such as the welding of stationary boilers and engines. The necessity for pre-heating this large work makes it unsuitable for women, as is any occupation involving intense heat or heavy lifting. The ship building industry has not used women welders since this class of work requires a high degree of strength, ability, and endurance. At least five hundred women have welded on munitions for our army. Many more have helped to make our airplanes.

The large companies making airplane motors and parts have been highly pleased with the results of employing women for this work. One manufacturer says:

"I found that on about fifty percent of our work that women are equal to men, on twenty-five percent women are superior to men, and on the other twenty-five percent men are superior to women. You will always notice that where women take an interest in their work you can depend upon one hundred percent efficiency. This is a valuable point to remember as in welding there is an excellent chance to camouflage as it is impossible to tell a perfect weld by visual inspection."

Types of Welding.

Welding of Drop Bombs. A good example of the simplest type of welding done by women on fairly heavy material is the welding of the seams of aerial demolition bombs. These bombs are loaded with high explosive and dropped from airplanes to cause explosions on contact.

The nose end of the bomb "shell" or casing is of fairly heavy steel and must be welded to the rear end of drawn steel. A rod is placed through the center of the shell which revolves on the axes of a stand which is adjusted to the height of the worker. The shells are brought to the welders and adjusted for them by men helpers. * * *

The welding of the seams of the incendiary drop bombs is a very similar process but requires somewhat greater dexterity and skill because the metal is thinner. It therefore burns through more quickly and a hole or a poor weld is not so easily repaired as in the heavier work where a smooth surface is not so important.

Welding on Motor Parts.

Probably the most highly skilled welding operations upon which women are generally engaged are those in the manufacture of motor parts such, for instance, as the different steps in welding the pressed steel water jacket into shape and attaching it to the cylinder of the Liberty Motor.

The first of these is tacking the seam of the water jacket in six places. The water jacket must be adjusted in a clamp so that when the heat is applied the two edges of the seam will not spring so close together as to make the diameter of the water jacket too small. The operative must make three or four adjustments of the clamp for each seam. One woman does this tacking. Another welds the seams together. Both

REGO WELDING AND

ASK THE USER

If you want a line on the PERFORMANCE of welding and cutting apparatus, ASK THE USER. Ask the man in overalls, the operator, the fellow who handles the torch. He sees it at its best and worst; he can tell its features and its faults, its speed, convenience, economy, whether it does or does not, make good. HE KNOWS.

WHAT DO REGO USERS SAY?

"We have put the REGO welder in use and it is the best torch, not only in construction, but also in operation, the writer has ever seen."

So "New England" wrote the other day, and "New England" has seen (and used) a good many torches in his ten years' experience.

"We have been using and selling REGO apparatus for a little more than three months now, and the results attained in our shop are more than satisfactory; from the sales we have made, we have received not a word of complaint, but many of praise.

"It's a pleasure to handle an article you thoroughly believe in, that you know will stay sold.

"We want to sell a lot more REGO apparatus; we wish to do more advertising—"

That's what "Louisiana" tells us; "Louisiana," who has run a shop and sold apparatus for a long, long while.

"The second day after receiving the apparatus, I had a good chance to test the welder.

"We had a 12-inch 'L' to shorten four inches, bringing the base up to the webbing. The aperture was 6 inches deep and 1 inch wide on all sides; the metal 7/8 inch thick.

"One welder started on the opposite end with an ——— No. 10 tip using 18 pounds of each gas. His torch back-fired so badly and became so over-heated he was forced to give up. I finished the three remaining welds, 9 inches long each at the base, welded on both sides, in exactly 63 minutes.

"I am a welder of over ten years' experience. Let me say this: REGO is 'SOME TORCH' from any angle you take it."

Rego Users Like Rego Apparatus

We didn't ask for these letters. They're spontaneous; the writers simply couldn't help sending them. Perhaps they had been sour, in trouble, discouraged. They tried REGO, and were happy.

SEND FOR OUR LITERATURE. We have a torch you will like, too.

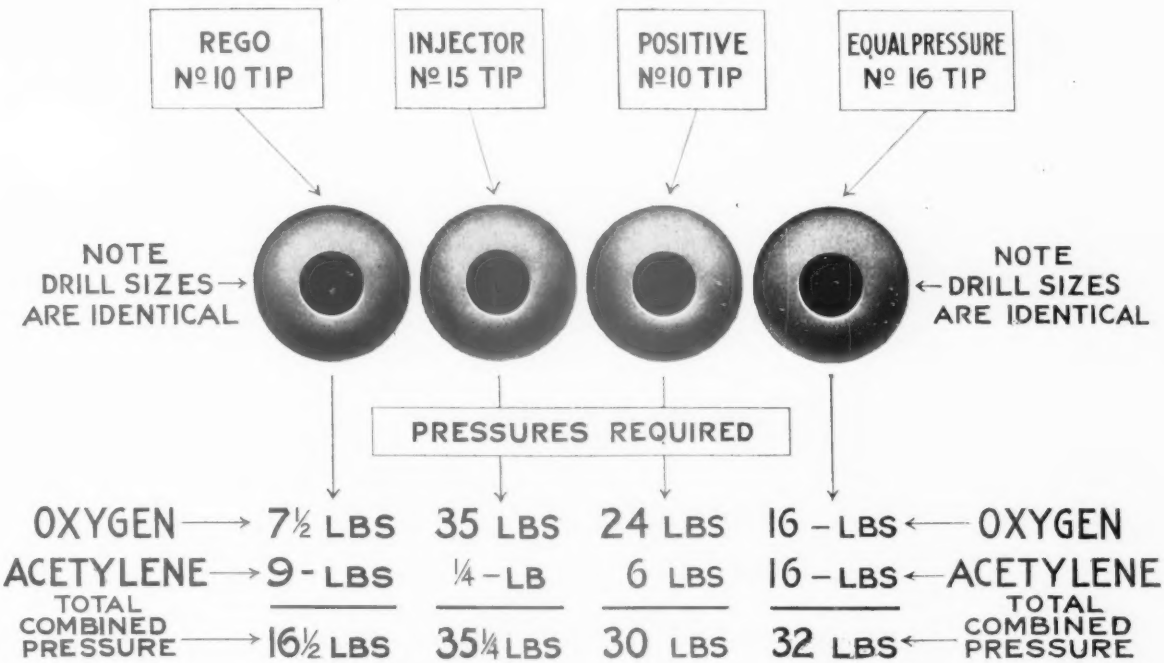
THE BASTIAN-BLESSING

UTTING APPARATUS

GAS ECONOMY

is one of the features users like best about REGO apparatus, not only because any saving of gas means reduced operating cost, which means more money in the user's pocket, but because REGO GAS ECONOMY IS REAL, SUBSTANTIAL. It amounts to something.

STUDY THE CHART.


REGO
№ 10 TIP
INJECTOR
№ 15 TIP
POSITIVE
№ 10 TIP
EQUALPRESSURE
№ 16 TIP
NOTE
DRILL SIZES →
ARE IDENTICAL
← DRILL SIZES
ARE IDENTICAL
PRESSURES REQUIRED
OXYGEN → 7½ LBS 35 LBS 24 LBS 16 – LBS ← OXYGEN
ACETYLENE → 9 - LBS ¼ – LB 6 LBS 16 – LBS ← ACETYLENE
TOTAL COMBINED PRESSURE → 16½ LBS 35¼ LBS 30 LBS 32 LBS ← TOTAL COMBINED PRESSURE

Which Torch Uses the Least Gas?

Many other striking qualities of the apparatus appeal to REGO users. It is based on a new and indisputably correct principle; YOU CAN'T BACK FIRE A REGO WELDER; it's extremely simple; gases mix in the tip—theoretically and practically the right place—securing the correct volume and velocity of gases for each flame size; the flame is always "soft," free from the common excess of oxygen that destroys a weld; there are numerous mechanical refinements; our guarantee is the pledge of a responsible house.

REGO Model "L" welding torch with ten nickel copper, one piece tips sells for $40.00.

REGO Model "C" cutting torch with four nickel copper one piece tips sells for $45.00.

YOU WILL LIKE REGO APPARATUS. GIVE IT A TRIAL!

C PANY WEST AUSTIN AVENUE AT LA SALLE STREET CHICAGO

operations require some skill, both because the rolled steel of which the water jacket is made is very fine and thin and therefore easily burned, and also because of the necessity of having the diameter of the jacket exactly correct. One thirty-second to three thirty-seconds of an inch leeway may be allowed in tacking the seam, according to whether the jackets have been annealed or not before welding.

Other welds on the motor cylinder are those of the edge of the pressed steel water jacket onto the bottom of the cast and machined steel cylinder and welding the jacket to the valve stem of the cylinder. These are similar to the one just described.

Machine Welding. The acetylene welding machine is used for welding seams of straight tubing. The set-up consists of an oxy-acetylene torch held rigid so that the inner cone just touches the seam as the tubing is passed through under the torch. The operative tends two machines, simply feeding in the tubing and making any necessary adjustments of the flame. The work is easy but necessitates almost constant standing.

Changing Shop Methods

The changes in welding equipment and methods which have been introduced to make possible the employment of women in the occupation are for the most part the same which are dictated by the use of any semi-skilled labor for these operations. Where the problem is the maximum number of welding inches three considerations are of prime importance: good equipment, economy of motion, and the elimination of fatigue.

The use of conveyors has eliminated the lifting and carrying of parts and made available all of the time of the operative for actual welding. The work is rendered at the same time much less fatiguing.

Revolving cradles to hold the work have obviated strained and inconvenient positions on the part of the worker and given her more time to cultivate speed and dexterity in handling the torch and wire.

Adjustable chairs by increasing comfort and convenience of position and thus reducing fatigue are regarded as a factor in satisfactory production. * * * * *

Working Conditions

Shop Construction. Working conditions for women welders vary greatly with the individual concern. Better conditions are generally found in the larger plants where the welding department can be segregated from the other shop processes. The confusion of a noisy shop is particularly troublesome to the welder, not only because she must concentrate her attention very closely upon her work, but also because the dark goggles shut out the sight of everything but the flame, the wire, the spot of white-hot molten metal at the weld, and the larger area of red-hot metal surrounding it. A sudden noise may easily cause a startled gesture with the torch resulting in a bad burn. * * * * *

Hours. Data concerning hours and wages were available from 11 of the 28 companies known to be employing women as acetylene welders. This affects 369 of the total 894 women known to be so employed.

An eight-hour day was in force in only two of the plants. One company maintained a ten-hour day, and the others were equally divided between nine and nine-and-a-half hour days. It is important in work demanding as close attention as welding that the welder have occasional let-ups in her work. Where the welder must wait for each piece of finished work to be inspected and taken off the cradle and the next one put on a recurring rest period is created. Where this is not the case it has been found advantageous to introduce rest periods of ten minutes at the end of each two hours of work.

Wages. The lowest beginning rate prevalent in these eleven companies was 22½c an hour which was the rate in force in three plants. The other companies paid a beginning rate of 25 to 30c an hour.

Experienced welders are usually paid a piece rate. The average hourly earnings for piece workers varied from 25 to 70c an hour. The majority of workers received 45c or over. It is doubtful, however, on account of poor time keeping and irregular work whether a majority of these piece workers earned as much as $25 a week.

Training

With the sudden demand for large numbers of welders, the old slow methods of training by apprenticeship had to be abandoned. The Navy, Army, and the Bureau of Aircraft Production all started welding courses as did also the engineering and automobile schools of the country. Shop training of more or less formal character has been given to the larger number of women who have been engaged in the semi-skilled work.

Time required. It is the unanimous opinion of men responsible for the training of welders that there is in every group a certain number of persons who can never master the art of welding. These should be weeded out in the early part of the training course.

The training time varies greatly with the individual. Experts say that it takes years to produce a really good all-around welder, in spite of the fact that a number of thirty-day courses are offered at present.

The shop training for one operation on one metal is, of course, a much simpler and shorter process than general welding training. It is difficult, however, even to state a minimum training time for one operation since individual adaptability to the work varies so greatly. Probably several days should be devoted to training for such an operation as the welding of demolition drop bombs. For the more complicated operations on finer metal such as the welding of motor parts, different companies give the necessary time as from one week to three. Manufacturers agree on three points: the time allowed must vary with the individual; training time for women need not be longer than for men and may often be shorter; training time is materially shortened by means of a training room separated from the shop.

Separate Training Rooms. The separate training room has proved more satisfactory than training in the regular shop. It gives an opportunity for the welder to become accustomed to her apparatus and to work away from the noise and confusion of the shop, and enables her to make much more rapid progress. By making use of a separate set of apparatus, she may take her time in learning methods of work without holding up the production schedule in the

The separate training rooms not only make easier a careful weeding-out of unpromising pupils, but also permit a better choice of the teacher. The best welder often is not a good teacher. The foreman who can manage his shop excellently may not be able to give clear explanations of how or why a given operation should be performed in the prescribed manner, and it is in the clear understanding of instructions and the reasons back of them that the most important foundation of good training lies * * *

Points to be covered. All welders, irrespective of the particular work they are to do should first be made thoroughly familiar with the equipment and apparatus in the shop. As a general thing it has been found better for the women not to regulate the pressure of the gas until they are thoroughly expert welders, but they should know the use and proper regula-

tion of every part of the apparatus in order to avoid danger of accidents from careless handling.

The introduction of the workers to the equipment in most training rooms includes careful instruction in just how to adjust the flame and keep the torch and tip in good working order. A poorly adjusted flame may entirely spoil what would otherwise be a good weld.

The welder is also taught something of the material on which she is working, for instance, the difference between pressed and cast steel in their reaction to the flame, and is carefully instructed just how to hold the torch so as to get the maximum of heat directed at the most important part of the weld and to save unnecessary motions.

It is found generally more satisfactory to start training on scrap metal. The length of time before the operative is put on direct production varies with the class of work, welds on finer metal requiring longer training. From the training room the welder can go directly into quantity production in the shop without causing loss from spoiled material.

Cost of Training. Few data have been accumulated on the cost of training women. This must vary widely with methods adopted and the degree of skill aimed for. One manufacturer who employed women for welding on aerial bombs estimated the cost of training at $80 for each worker. * * * * *

Future Scope of Welding as an Occupation for Women

* * * * * * welding has been a very attractive field for women. Training for the less skilled operations may be easily and quickly obtained. The work gains in interest, and is always presenting the worker with opportunities to increase her skill. The pay received is considered good.

The future scope of the welding field for women is hard to predict. Welding as an industry is only in its infancy and the demand for welders therefore may not be materially decreased with the cessation of war production. Men will always be preferred for many sorts of welding and perhaps for all classes when the supply of men and women is equal, but women have demonstrated that they are better suited to the lightest sorts of welding than men. Manufacturers who had a force of women welders for war work did not give them up for men unused to the shop and methods, but made arrangements to shift their women welders from war to peace production. There seems no reason why women should not enter the field of general automobile repair work and skilled welding if the demand for welders continues ahead of the available supply of men welders.

Numbers of Women Acetylene Welders Reported Employed on Army, Aircraft, and Commercial Work, November 1, 1918.

State	Army	Aircraft	Commercial	Total
California	....	....	5	5
Connecticut	50	....	....	50
Illinois	150	....	5	155
Indiana	5	22	24	51
Massachusetts	25	3	....	28
Michigan	45	310	9	364
New Jersey	4	5	....	9
New York	14	110	2	126
Ohio	25	....	....	25
Pennsylvania	75	6	....	81
Total	393	456	45	894

Note. It is possible that a small number of the 45 women classified as doing commercial work are engaged for part time at least on Government work.

Editor's Note. The introduction of women into the welding industry, both in this country and abroad, is of great interest, hence the publication of this information. No doubt more than 2,000 women welders were employed in the industry at the close of the war.

RECLAMATION AND WELDING.

By B. K. Smith.*

Mr. William Fleming French has given us, in the November issue of "Popular Mechanics," the benefit of his studies in saving the railroads millions of dollars by reclamation and conservation of second hand material, at the railroad scrap yards. In his article he gives us a splendid illustration of the possibilities in the line of conservation and economy, and the figures obtained in such saving reached the $25,000,000 a year mark.

It is certainly wonderful to see the reclamation of old bolts, nuts and washers; hose and couplings; pipes and fittings; old boiler tubes flattened and stamped out, two washers at a time; utilizing old car roofing into various railroad equipment and many other articles that contributed in the decrease of the scrap pile.

The author also illustrated in detail the reclamation shops, such as the Blacksmith, Tin and Hose shops, where all the savings were accomplished, and the writer, after reading the whole article, was very much disappointed to miss the one most effective reclamation agent, The Welding Shop.

Mr. French probably overlooked the oxy-acetylene torch, the electric welding machine, and the termit welding crucible. These three tools are not only contributing in reclaiming over 50 per cent of the defective materials, but are also contributing in keeping locomotives and cars longer in the service, and less in the shops.

Furthermore, the possibilities of increasing the saving with the welding torch, electro handle or crucible are unlimited and could be increased 80 per cent of our present operations.

The writer has recently visited a great many private junk yards, and to his regret has seen hundreds of cracked or broken steam locomotive cylinders that were not obsolete and that could be welded on the locomotive at a saving of $600 or more per cylinder. He also saw a great number of railroad frogs, diamond crossings and switch points, scrapped and sold as junk because they were worn out on the surface. Only those men that have to pay for these articles would realize what a tremendous saving it would be if these frogs, crossings, or switch points could have been welded in place without removal. A few yards further on in that yard the writer noticed a big pile of air brake equipment, such as triple valves, automatic brake valves, air pump cylinders, and distributing valves. Some had a lug or corner broken off, others had some threads stripped or worn out, some were cracked, but seventy-five per cent of this equipment was weldable, at an enormous saving.

In the same article Mr. French states that a shortage of forty per cent of zinc and fifty per cent of tin is estimated for 1919, yet there is a great waste of these materials, and even an amateur can notice this waste.

When standing in front or side of a locomotive one can see a great many brass oil cups, which can be substituted with welded sheet metal oil cups. These cups also have brass covers which are lost in great quantities. When they are out of stock some roads are making sheet metal covers to replace the brass ones. Why not make the whole cup and cover out of sheet metal and save the zinc and copper, plus cost of manufacturing?

There are for each locomotive about fifty brass connections, nuts or unions, that are brazed or screwed on branch steam or overflow pipes. Is there any reason why these cannot be replaced with iron ones?

*United States Welding Co.

EVOLUTION OF AN ARC WELDING TOOL.

By Otis Allen Kenyon.

The electrode holder or welding tool is a much more important element of a welding plant than many people realize. In the early days, we used to make a welding tongs as we called it, by having the blacksmith split a piece of iron about 6 inches long to within about 1 inch of the end, and then form the two sides into a pair of spring jaws. We then welded the solid end into a piece of gas pipe and attached the cable to the other end of the pipe. A few feet along the cable, we installed a knife switch in a box, so that

Fig. 1.

the welder could cut off the current from the handle when he wished to lay it down. The welder wound friction tape around the pipe to suit the comfort of his hand.

In order to operate such a holder, we required an opener which looked like an off-set screw driver. This opener was inserted and turned so as to spread the tongs every time the electrode was changed.

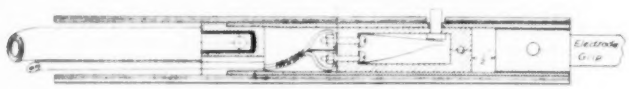


Fig. 2

When we introduced our remote controlled arc, we required a small control switch in the welding tool handle, and it was then that we first gave the matter serious attention, and there followed a rapid development of devices, until the present type which we consider to be in every way a success.

It is thought that a brief record of this work should prove of interest to those who follow arc welding practice, and for that reason we have set it down here.

The first type of tool was patterned closely after our old practice of long standing.

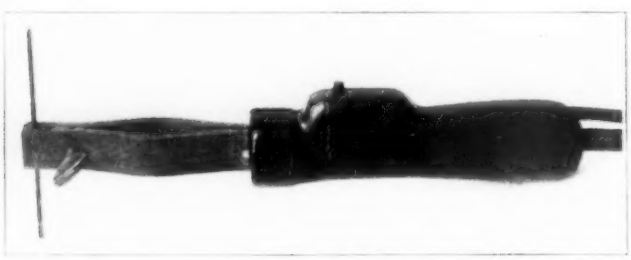


Fig. 3.

Fig. 1 shows a photograph of the tool and the opener, together with a scale to give an idea of the size.

Fig. 2 shows a cross section of the tool from which it is seen, that its construction was quite complicated. We were not satisfied with it, because it was heavy, clumsy and expensive, and the numerous mechanical joints in its structure caused it to heat up easily. In fact, if the joints were not practically perfect, it would get so hot, that the welder would have to stop from time to time and wait for it to cool off.

This type was followed by a similar holder, in which a copper rod was welded into the tongs on one end and into a cable lug on the other. The handle was slipped over the rod and carried a control switch on its periphery. This handle was not a success, on account of imperfections in the method of mounting the control switch, and also on account of its clumsiness and weight.

The next tool was made up as shown in Fig. 3. A special handle of wood was made with a chamber at one side which contained the remote control switch. The tongs were riveted and welded to a brass tube into which the cable was soldered. The opener was discarded and a thumb screw used in its place. In practice, the thumb screw was set to spring the tongs almost wide enough open to take the size of welding pencil to be used, then less than a half a turn of the screw would be sufficient to permit the insertion or removal of an electrode.

Fig. 4.

The objection to this tool was breakability of the wooden handle and trouble experienced in teaching welders how to use the thumb screw.

The next development was a moulded handle, similar in form to the wooden handle of the previous type and the solid brass welding head which contained a spring acting against a solid slotted plunger. (See Fig. 4.) The construction of the welding head is shown in Fig. 5. The end of which projected from the front end of the welding head and served as a button for releasing the spring. In operation, the button in the end was pressed against the work or any other convenient place, the welding pencil inserted and the button released. When finished, the electrode was released by merely pressing the button on the end. This electrode holder being always dead when the electrode was changed,

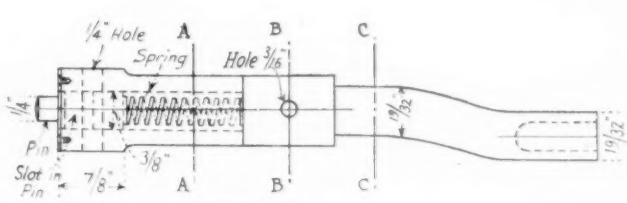


Fig. 5

required no insulation for the operating button. The reason this type was abandoned, was that, if the spring which clamped the electrode was made strong enough to stand the pull when the electrode stuck to the work, it was difficult to operate it.

The next step in advance, was the substitution of a clamping device for the spring. This holder employed the same

moulded handle as the previous one, the welding head containing an inclined groove in which a knurled ball was free to roll back and forth. When the holder was held upside down, the ball rolled out of the way, and the electrode could be inserted, then the holder was turned over and the end of the electrode knocked against something to jam the ball between it and the inclined track, thus holding it fast. When the welding was completed, a light rap on the welding end would release the ball and the electrode would fall free from the holder. Adjustment for different size pencils was made by moving the outside part of the welding head farther from or nearer to the inclined portion on the interior. This holder was not satisfactory, because the inclined portion

Fig. 6.

of the clamp was too short to allow sufficient variation in the size of the opening.

The next type was an elaboration of the previous one, which is shown in Figs. 6 and 7. Instead of a ball, it contained a knurled roller and in the top there was a trigger which held the roller in a little pocket. It was operated by inserting the electrode and causing it to lift the trigger, allowing the roller to drop down into the space between the electrode and the inclined track. The track being long enough, so that the space would permit the gripping of any electrode from $\frac{1}{16}$" to $\frac{1}{2}$" diameter. When it was desired to release the electrode, the short end was pressed on the under side of any convenient object, which released the roller and opened the trigger. The roller then dropped into the pocket and the trigger held it there, leaving the electrode free to drop when the tool was turned over. This device worked beautifully and required only one hand to operate. The electrodes could be picked up from a receptacle and released without changing the grip on the tool handle, and without the use of the other hand. However, it could not be used for pencils smaller than $\frac{1}{8}$", on account of the fact that small pencils vibrated too much on the end with an ordinary

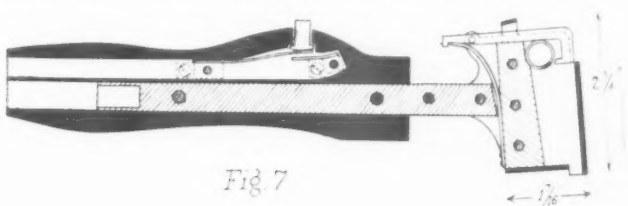


Fig. 7

length, and with short lengths there was too much waste, because this holder gripped the pencils on the end. For this reason, and on account of expense, it was abandoned.

The final type is shown in Figs. 8 and 9. In this holder, the clamping principle of the last two types is retained, except that the clamping device is given a positive motion by a lever on the side of the welding head. There are no joints in this tool, except where the cable is soldered into the end of the shank. The current passing straight through the solid casting to the welding head, where it has a large area contact with the electrode, the electrode being pressed firmly against this contact area, by means of the case hardened spiral segment operated by the lever. The curve form of the welding head utilizes the spring action of the electrode itself, to prevent slippage.

With this holder, it is impossible to pull the electrode out of the holder. It can only be released by turning the lever. Being a positive mechanism, the time of changing an electrode is absolutely definite, and can be taken accurately into account in making estimates for production.

On a production job, it is possible to arrange a slot near the welder into which the welding head can be inserted. This slot being so made, that it will engage the operating lever, then the welder can release or grip the electrode, by swinging the handle up or down, which still further reduces the time required to change an electrode.

Fig. 8.

The holder here shown is of the type used with the closed-circuit system of control, the button being used for momentary contact control and the trigger for maintained contact control. The trigger in Fig. 9 operates the cut-out mechanism. Normally, the welding head is dead. In order to obtain power for welding, the welder must press and hold the trigger. When he released the trigger, the power is cut-off. If he should pull a longer arc than the adjustment is set for and still hold the trigger, he is cut-off automatically, and cannot be re-connected until he has released the trigger and pressed it again.

ELECTRIC WELDING.

Electric butt welders have been used since 1895 to weld terminals on refrigerator coils after bending. The sections are first cut into lengths, and then bent into shape, and finally assembled on a butt welder. The cost is said to be about 2½ cents per weld, including labor and current.

Spot welders are used to weld 16 gauge steel cabinet drawers. There are 36 welds to each drawer, and they are being

Fig. 9.

welded at the rate of a drawer every five minutes. The current cost per drawer is .025 cents.

The Institution of Engineers and Shipbuilders in Scotland have published, in pamphlet form, "Notes on Welding Systems," by Captain James Caldwell, R. E. This report is very similar to the one recently published in this country by the Emergency Fleet Corporation, and which was mentioned last month. Captain Caldwell is the English arc welding expert who was loaned to the Emergency Fleet Corporation.

IS WELDING A TRADE?

For a number of months *The Welding Engineer* has been publishing communications from readers relating to the recent ruling of the Director General of Railroads, classifying the work of autogenous welding on railroads. (See page 18, *The Welding Engineer* for August 1918.) The November, 1918, issue of the "Railway Carmen's Journal," published at Kansas City, Mo., contains some interesting sidelights on the union view of the situation. In the leading editorial this union publication says:

General President Ryans Interpretation of Decision Rendered by the United States Department of Labor, Division of Conciliation, Relative to Jurisdiction Over Use of the Oxy-acetylene, Thermit and Electric Torch.

"Embodied in the proposed national agreement to be submitted shortly to the United States Railroad Administration, published elsewhere in this issue, will be found the United States Department of Labor, Division of Conciliation's decision upon the much moted question of jurisdiction over the use of the oxy-acetylene, thermit and electric torch which should be read in connection with this article.

"Upon receipt of this decision from the Secretary of Labor, efforts were made by the Executive Council of the Railway Employes' Department of the A. F. of L. to secure some interpretation of the award in order that there might be no room for further argument or controversy. The arbitration board, however, declined to give any further interpretation, claiming that their decision was plain enough to be understood by anyone who desired to understand.

"Under date of September 23, 1918, President Ryan therefore made this question the subject of a special circular letter to our membership, in which he outlined his interpretation of this award as follows:

"To Officers and Members of all Lodges, B. R. C. of A. Greeting:

"Since the introduction of oxy-acetylene, thermit, and electric process of doing work, there have arisen controversies and jurisdictional disputes between several of the organizations affiliated with the Railway Employes' Department.

"Our organization had a jurisdictional dispute with the blacksmiths over the following work: Welding truck sides, welding bolsters, welding couplers cast steel, welding transoms, and welding coach frames. These jurisdictional disputes have been discussed time and again by the General Officers as well as the Executive Council of the Railway Employes' Department. We were never able to reach any understanding or agreement. At the St. Louis convention of the Railway Employes' Department, last April, it was decided to submit all questions in dispute between the several organizations to arbitration. It was further agreed that Hon. William B. Wilson, Secretary, U. S. Department of Labor, be requested to appoint the arbitrators.

"I therefore submit for your information and attention the decision of the Board of Arbitration in its entirety.

"As the decision affects the membership of our organization, your attention is called to the following statement contained in the decision of the Arbitration Board:

"'The oxy-acetylene torch is in effect a tool which is easily transportable, which conveys through a tube a flame of such high temperature as to be able to cut through a piece of steel, cut off rivet heads, weld together ends of a broken piece of iron or steel; fuse and build up worn places, etc. It has, in fact, revolutionized the entire method of doing repair work in the locomotive departments, car departments, blacksmith shops and boilermaker shops of the railroads. The disturbance thus created among craft line trade unions must of necessity be very intense. IN THE INTEREST OF INDUSTRIAL PROGRESS, HOWEVER, THE EXCLUSIVE USE OF A TOOL OR PROCESS CANNOT BE CONCEDED TO A SINGLE CRAFT OR ANY GROUP OF WORKMEN.'

"You will please note that the exclusive use of a tool or process is not conceded to any single craft or any group of workmen. Therefore, it gives the members of our Brotherhood the right to use the ovy-acetylene machine in doing our own work.

"The decision also very clearly and specifically defines welding as follows:

"'By welding is meant the uniting of two ends or pieces of iron or steel broken completely in two or two separate pieces of iron or steel, by means of heat.'

"Welding as defined above is granted exclusively to blacksmiths. WELDING SHOULD NOT, HOWEVER, BE CONFUSED WITH FILLING IN, FUSING, OR BUILDING UP WORN PARTS OF A PIECE NOT BROKEN.

"I therefore interpret the decision of the Arbitration Board to mean, so far as the work in controversy between our organization and the blacksmiths, with reference to repairs to truck sides, bolsters, couplers, transoms and coach frames, if any of the above items are broken entirely in two and they are to be repaired by welding, then it is blacksmiths' work. If any of the above items are fractured or cracked and can be repaired by fusing, melting, or building up worn parts, my contention is that the work belongs to the car men. In other words, we claim that building up worn parts of a piece not broken, or fusing, or melting with oxy-acetylene torch is not welding and so decided by the Board of Arbitration.

"Now, brothers, it is the duty of every member of our Brotherhood to see to it that blacksmiths are not permitted under any circumstances to use this tool on any work that belongs to car men. Just keep in mind that in doing our work we have as much right to use the oxy-acetylene machine as any other class of mechanics.

"In conclusion, I trust that the officers and members of our Brotherhodo will not permit any trespass on our jurisdictional rights.

"MARTIN F. RYAN,
"General President."

PROPOSED AGREEMENT TO BE SUBMITTED TO THE UNITED STATES RAILROAD ADMINISTRATION.

Agreement between the Railroad Administration of the United States Government and the following organizations:

1. International Association of Machinists.
2. International Brotherhood of Boilermakers, Iron Ship Builders and Helpers of America.
3. International Brotherhood of Blacksmiths and Helpers.
4. Amalgamated Steel Metal Workers' International Alliance.
5. International Brotherhood of Electrical Workers.
6. Brotherhood of Railway Carmen of America.

General rules are omitted except as follows:

9-B. In compliance with the special rules covered by this agreement none but mechanics and their apprentices in their respective crafts, shall operate oxy-acetylene, thermit, or electric welders. Where oxy-acetylene or other welding processes are used, each craft shall perform the work which was generally recognized as work belonging to that craft prior to the introduction of such processes.

Men operating these machines will receive 6 cents per hour above regular mechanics' rates. Apprentices will not be allowed to operate these machines without being accompanied by a mechanic of his craft at all times.

Miscellaneous.

8. All acetylene or electric welding or cutting will be protected by a suitable screen.

Department of Labor, Division of Conciliation, Washington.

To the Secretary of Labor:

The accompanying award of the board of arbitration is made in conformity with your letter of appointment dated May 31, 1918, and addressed to Messrs. Ethelbert Stewart, John A. Moffitt, and Charles Bendheim, of the Department of Labor, as follows:

"Pursuant to the request of Messrs. A. O. Wharton and John Scott, President and Secretary-Treasurer, respectively, of the Railway Employes' Department of the American Federation of Labor, that I appoint a board of arbitration to pass upon certain jurisdictional matters relative to blacksmiths, machinists' boilermakers, carmen, etc., of the railway employes, the decision of such board to be final and binding upon all crafts involved, I have designated you as a committee to act in that capacity.

"Sincerely yours,

(Signed) "W. B. WILSON,

"Secretary."

The board thus designated met and listened to the statement of the parties in interest for a period covering about one week during the month of June.

Having given to the matter such consideration as we were able, we have arrived at the following general conclusions upon which the award was based. The questions at issue refer solely to repair work and not to the construction of new engines and cars or other railway equipment. The issue is squarely that of jurisdiction over different classes of work by organizations composing the Railway Employes' Department of the American Federation of Labor. Not all of these affiliated organizations are involved in the matter brought before the board. For the most part, the questions presented for adjustment grow out of the discovery, and the application of electricity and oxy-acetylene to the mechanical trades. The oxy-acetylene torch is in effect a tool which is easily transportable, which conveys through a tube a flame of such high temperature as to be able to cut through a piece of steel, cut off rivet heads, weld together ends of a broken piece of iron or steel; fuse and build up worn places, etc. It has, in fact, revolutionized the entire method of doing repair work in the locomotive departments, car department, blacksmith shops, and boilermaker shops of the railroads. The disturbance thus created among the craft line trade unions must of necessity be very intense. In the interest of industrial progress, however, **the exclusive use of a tool or process cannot be conceded to a single craft or any group of workmen.**

The hammer and its use, as a matter of principle, is necessarily free to all. The form or shape of a hammer may differ in accordance with its intended use, a different shaped hammer for a blacksmith, a carpenter, gold beater, or jeweler. But the tool designated as a hammer and the process of hammering cannot be claimed by any craft, as such. This is not true solely because the hammer was the first tool invented by man, but because the principle involved is basic in the very essence of industrial organization. A tool invented yesterday having the general application to mechanical work that is possessed by the hammer must immediately be shared by the mechanical trades in the same sense that the hammer is shared. Likewise the use in manipulation of materials cannot be conceded to any one craft or class of men.

In the jurisdictional friction between the boilermakers and the sheet and metal workers, the line of demarcation between the two crafts was fixed by a mutual agreement to the effect that work done on or with sheet steel or iron of 16 gauge or heavier should be boilermakers' work, while under that gauge belonged to sheet metal workers, but this could not be conceded by your board as placing the boilermaker in control of material of that gauge or heavier when used for other purposes, though the use of that metal in the manufacture of boilers or in the repair of boilers is easily concedable. Hence the claim of the boilermakers that "the marking off and cutting of sheet steel or iron of No. 16 gauge or over for the use of other trades, such as liners, plates," etc., should be their work involved a proposition too wide in its scope, it seemed to the members of your board, to be conceded. This principle of the freedom of tools and material is intended to be held to strictly throughout the terms of the award of this board.

On the other hand, the nature of the work done, object sought, or the purpose accomplished, must, in the opinion of your board, be the general guiding principle in all adjustments involving jurisdictional disputes. For instance, welding, by which we mean solely the joining of two separate pieces of metal together to form one united piece; no matter with what tools or by what process it is accomplished; welding, it has seemed to your board, is a process, however accomplished, which is essentially coupled with the work of a blacksmith. While heretofore it has been necessary to take the two parts, whether new or broken, to the blacksmith shop to be heated in his fire and welded on his anvil, and while the discovery of the oxy-acetylene torch enables this to be done outside the shop with very much less skill on the part of the worker, this makes welding none the less the work of a blacksmith. As an example, heretofore when any part of an engine frame was broken in two it was removed from the engine, taken to a blacksmith shop and welded. In such cases there was no jurisdictional dispute. It was admittedly the work of a blacksmith. Today an engine frame may be broken squarely in two at some point in the frame and the ends may be welded quickly and successfully without removing the frame from the engine by use of the oxy-acetylene or the electric process; thus the work is much more quickly and cheaply done, and the use of the process is rapidly expanding. The discovery of this new method ought not, in the opinion of your board, to operate to exclude the blacksmith craft, while craft lines exist in railroad shops and yards, from the work which heretofore has been distinctly his. In the performance of all tasks distinctly his it should make no difference whether the work is brought to his fire or whether he carries the fire to his work. The essence of jurisdiction is the nature of the work performed, the object sought, the purpose accomplished. While it is true that machinists have in the past used methods which may roughly be called splicing for holding the broken pieces together for a time, yet welding has not been the function of a machinist. On the other hand, by means of this oxy-acetylene process a worn place may be built up by what is here called fusion, for the purpose of distinguishing it from welding, which term is here confined to the uniting of two broken ends. Fusing, in the sense in which it is used here, means practically the melting or fusing into a hollowed out or worn place the metal which will build the part up flush with the surface of the piece where not worn. It is in a sense a fitting or shaping. It was formerly done by various processes and means, by both machinists and blacksmiths, in fact, by car men, if not by all mechanical tradesmen, and the exclusive use of this torch for such a purpose could not, in the opinion of your board, be conceded to the blacksmiths or any other craft. On the other hand, where a piece is taken to the blacksmith shop for the purpose of welding or for other reasons, the right to fill in worn places on truck frames, etc., by the oxy-acetylene process by fusing metal into the worn parts, should be conceded to the blacksmith. With these general principles kept in mind, and with the specific understanding that where "oxy-acetylene or other processes are used, each

craft shall perform the work which was generally recognized as work belonging to that craft prior to the introduction of such process," and that introduction of a new process does not give any craft the right to claim an exclusive use of a process or a tool in order to secure for itself the work which it did not formerly perform, the specific details of the subject brought before your board are decided as follows:

Within the general lines indicated above, the following shall be boilermakers work:

Application of studs for the purpose of applying a piece of boiler plate to the outside of the firebox to prevent driving wheel from cutting shell. Application of studs in boiler head to support drip pan over fire door. Application of studs for grate rigging and ash pan work. Application of studs or bolts in frames where necessary to anchor ash pan hangers or wheel covers. The removing and applying of wheel covers. The removing and applying of steel running boards. The removing and applying of wind sheets on locomotives. The testing of air reservoirs.

Rolling super-heater pipes in front end heads. The right to apply all steps, brackets, headlight, boards, classification light brackets and other appurtenances when made out of 16 gauge or over.

Blacksmiths' Work.

As indicated in the text of this award, all welding of whatever kind, wherever and however done, is conceded to the blacksmiths. By welding is meant the uniting of two ends or pieces of iron or steel broken completely in two or two separate pieces of iron or steel, by means of heat, however applied; and welding as here conceded exclusively to blacksmiths is not to be confused with filling in or building up worn parts of a piece not broken, such filling in being here class as fusing or melting. Specific cases of welding as brought before the board may be here detailed, but only by way of example, as follows: Welding engine and truck frames, welding pistons, welding cross heads, welding motion work when broken, welding quadrants where teeth are broken out, welding link pins, welding trailer yoke brackets (jaw welding and plugging up), welding of driving wheel spokes, and all welding, wherever or however done.

Building up worn engine frames, flat surfaces on locomotive drive-wheel tires, and similar heavy work done by oxy-acetylene or electric process will follow the craft which generally did the work by which the same purpose was accomplished prior to the introduction of such processes. It is to be understood that by the rule "that where oxy-acetylene or other processes are used, each craft shall perform the work which was generally recognized as work belonging to that craft prior to the introduction of such process," this board means immediately prior to the use of such processes. What is meant is the customary distribution of types of work or specific jobs at the time of and immediately before the introduction of these new processes. There where well established trade, or craft customs, which generally controlled the distribution of work prior to these processes; and these customs, fairly followed, will insure a generally equitable distribution of work along craft lines under the use of this new tool, if craft lines can be maintained at all.

Machinists Work.

Cutting and building up metals with the electric and oxy-acetylene processes is conceded to the machinists, together with the free use of the oxy-acetylene torch as a tool in the prosecution of all work generally admitted to belong to them. Again referring to specific jobs by way of illustration, the following list, essentially as substituted to your board, is awarded to the machinists, provided that in no case shall it conflict with the accepted rule that work is to go to the craft which performed such work before the introduction of the electric and oxy-acetylene processes.

Repairing—Steam chests, covers and casings, except where made of sheet or boiler steel. Throttle boxes, exhaust stands, dome caps, nigger heads, stand pipes, steam pipes which are handled by machinists, pop or auxiliary domes glands, and stuffing boxes, piston heads and piston valve heads.

Piston valve and slide valves, cross heads, chafing plates and cab castings, engine truck center castings, shoes, wedges, eccentrics and straps.

Repairing cylinders and heads (this does not apply to brake cylinders on passenger and freight cars), patching of cylinders, steam chests, steam pipes, and front ends and doors where material of 16 gauge or heavier is used. This to include drilling, tapping and applying of patch bolts or rivets necessary to complete the job.

Deck castings, except steel deck castings, when straightened by blacksmiths, rockers and tumbling shaft boxes, air pump and heads and appurtenances, except pipes and connections.

All valves, except made of brass, and triple valves on freight and passenger cars.

Filling around bolt heads and nuts on machinists' work. Filling around edges of link, and guide yokes, liners on frame filling blocks and rod keys, pulleys, hangers and bearings in connection with shafting or machines.

Gears, gear castings and cast iron covers, machine boxes and beds, chucks, vises, except steel, and machine tool castings, filling around patches applied by machinists.

Where dismantling of machinists' work on locomotive is done by the acetylene torch, either by cutting off bolts or nuts or in any other manner with the torch same will be done by machinists.

Cutting off and cutting out all crank pins, brake post or brake hanger pins, also cutting off tires where same cannot be trued up to comply with the law, cutting out all bushings in connection with machinists' work, cutting brace or braces, yokes, blocks or other material in connection with machinists' work, which would have been done by machines operated by machinists, their apprentices or drill press men prior to the introduction of the oxy-acetylene cutting torch.

Building up taper fits on piston rods. Building up worn piston rod and rist pin holes in cross head. Filling in and repairing broken driving wheel spokes. Building up brake and expansion hanger post when not removed from frames and boiler.

Filling in D. B. Castings broken out.

Car Men and Blacksmiths.

In the matter of the issue between the car men and the blacksmiths, as presented to your board, the only proposition submitted related to welding truck sides, welding bolsters, welding couplers, cast steel, welding transoms and welding coach frames. On these issues, defining welding to mean the uniting of two separate ends of metal the board reiterates its decision that welding is the province of the blacksmith.

Respectfully submitted,

ETHELBERT STEWART,
Chairman.

JOHN A MOFFITT,
Member of Board.

CHARLES BENDHEIM,
Member of Board.

Note.—Several pages of rules governing the various trades occupied in railway shop work follow. They are very much along the foregoing lines and equally foolish.

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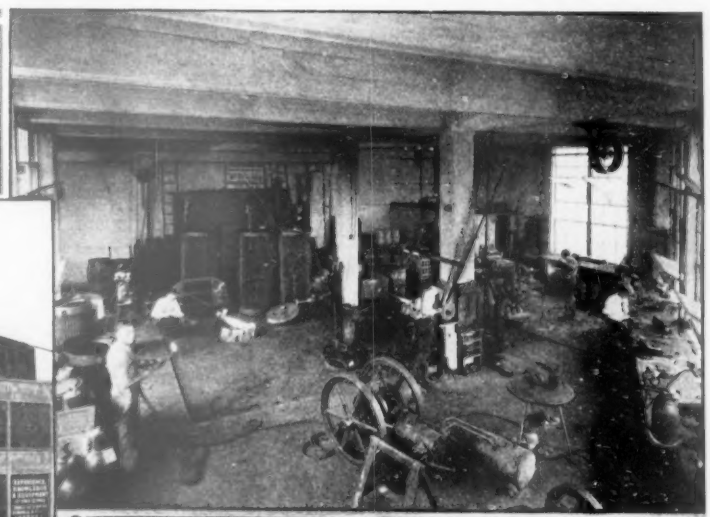

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608 S. Dearborn St., Chicago, Ill.

Telephone Wabash 7134.

L. B. Mackenzie.....President and Editor

Subscription payable in advance and postage free.

United States, Canada and Mexico.....$2.00 a year

Foreign Countries ..... 2.50 a year

Single copy, domestic .....20 cents

Single copy, foreign .....25 cents

Entered as second-class matter January 20, 1916, at the postoffice at Chicago, Illinois, under the act of March 3, 1879.

The Welding Engineer is a member of the Audit Bureau of Circulations.

Eastern Office:

171 Madison Ave., New York. Telephone, Murray Hill 4394.

Max I. Barth, Eastern Representative.

The Welding Engineer in Australia and New Zealand.

VOLUME 3 DECEMBER, 1918. NUMBER 12.

The Question of a Union.

IN THE past two years the welding trade has grown like a young weed. Time was when we published the photograph of a woman welder (English, by the way) as a great curiosity. When the war closed we had a couple of thousand of them in this country. All this took place in less than two years.

The welding trade is only beginning to find itself. In a short time most of the competent welders of today will find themselves in the position of owners of job welding shops or foremen of welding departments. This condition is sure to come about.

In the past three years the Editor of *The Welding Engineer* has never met a so-called welder who was not willing to "admit" at least **eight years** experience. How would you welders, if you were the boss, paying for the gas and supplies, and taking the kicks and the blame, like to pay the top price for every fellow who could "talk' a union card out of a walking boss? How many men do you know who hold forth as welders and whom you would rate as a good helper?

Well, if we had a welders' union, running under a set of dam fool rules, such as are published elsewhere in this issue, that's what you would do. In a short time every bleary-eyed gink who could detect a tip from a regulator would pass as a Master Welder, and Heaven help the old timer who tried to fire him, without knowing something about his political affiliations.

The Welding Engineer believes in organization and efficiency. The Editor thinks we must have, sooner or later, a society composed of the best welding talent in America. Such a society, we believe, would do much for all of us.

But we do not want to see a welding society run on the lines of the present organizations responsible for the belittling of the welding trade.

The National Welding Council.

BEYOND a doubt the creation of a National Welding Council by the Emergency Fleet Corporation is bound to be productive of good results. We understand a large amount of money is to be spent during the coming year on experimental work. No doubt the findings of the committee will be given to the welding trade, so that the whole industry will benefit. This work furnishes one more illustration of what the war has done for welding.

THE LIBERTY BELL.

Editor: The writer noted with some interest in your magazine under date of September, 1918, your editorial covering the welding of the Liberty Bell.

Personally, I would say it could be done, although my only experience with welding a bell was on one that had a wall four inches at the thickest point. I saved all the chippings and cut a straight groove down in, of an inch and a half wide, to the center of the thickness of the wall and from the other side I cut out the metal so as to leave a thin partition at the center section, which made a bottom to start on when welding from one side. I used the original bell metal chippings and added Tobin Bronze, and after I welded in and finished up half the wall and one side,I hammer finished it to help take care of contraction. We then placed the bell in another position and started our weld from the bottom of the other half of our chamber on the inside wall, and finished this up the same way and gave it a hammer finish and experienced no trouble whatever with cracking, and it kept practically the original tone. The job came out O. K. and was in use something over a year before they discarded it from our fire engine house and put in an electric siren fire alarm.

I certainly would be willing to do anything in my power to carry along such a plan as you suggest, of having a board of experts created, if it is possible to get those in authority at Washington to do so.

HOBBIE AUTOMOBILE COMPANY.
L. W. Hobbie.

PRESSURE WELDING.

Editor: At one of our steam plants we have a header and steam main in use, some joints of which were welded over a year ago, and there has been no signs of leaks at these joints or other weaknesses.

In renewing our boilers insurance the insurance company refuses to cover this piping, because of these welded joints. Part of our header is under a maximum of 180 pounds and 125 degrees superheat.

Is it generally understood that insurance companies have rules against welded headers? The insurance company's inspector stated that we might obtain insurance if the joints were annealed. It so happens that we cannot take the piping down to anneal it without completely shutting down the plant. Do you think that we could anneal the joints in place with a preheating torch? C. C. B.

Answer: It has been our experience that there are a number of insurance companies who consistently refuse to write insurance on what is known as tension welding. This is a matter which is receiving the earnest consideration of the recently organized National Welding Council, and it is to be hoped that some day we will be successful in establishing some uniform practice. It is a fact that there are several states in which it is unlawful to weld anything which is to be subjected to pressure.

So far as annealing this job is concerned, would state that you can best do it with an acetylene torch. Hold the torch a little farther away from the metal than usual and bring it up to a bright red at a point where a magnate will not be attracted. We think this is the best practice you can follow.

Editor.

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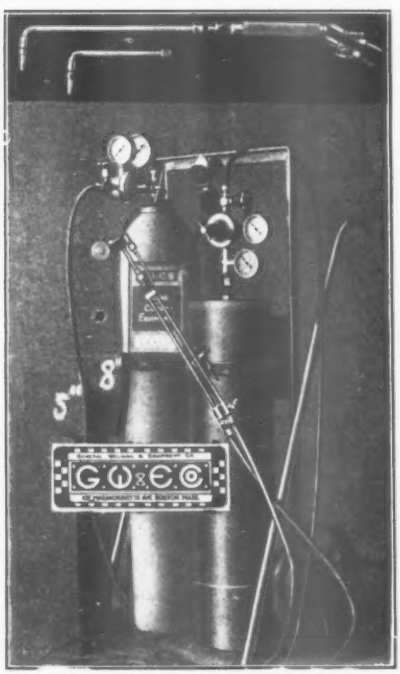

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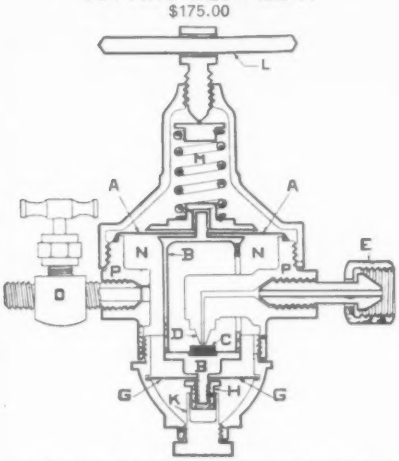

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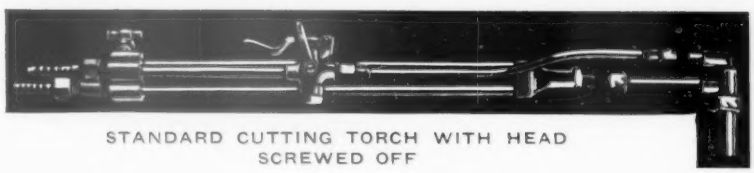
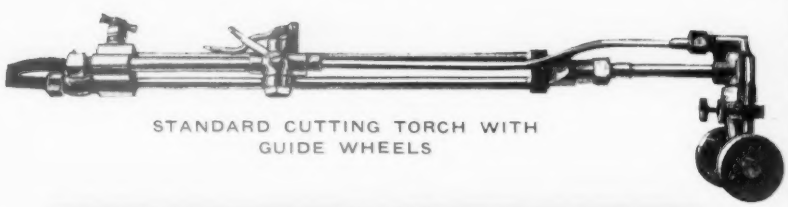


STANDARD CUTTING TORCH WITH HEAD SCREWED OFF



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3. CUTTING TORCHES are second to none in efficiency, economy and endurance. Everything is of the most modern open construction. Each part can be reached and inspected without delay. The picture on top shows a torch with the head separated from its base. By loosening two screws the whole head comes off, showing how easy it is to exchange even a complete head.

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4. Everything in our constructions is easily accessible and exchangeable. With carrying a few spare parts you can do your own maintaining even in far away countries.

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TEST OF ARC WELDED SHEET METAL TANK.

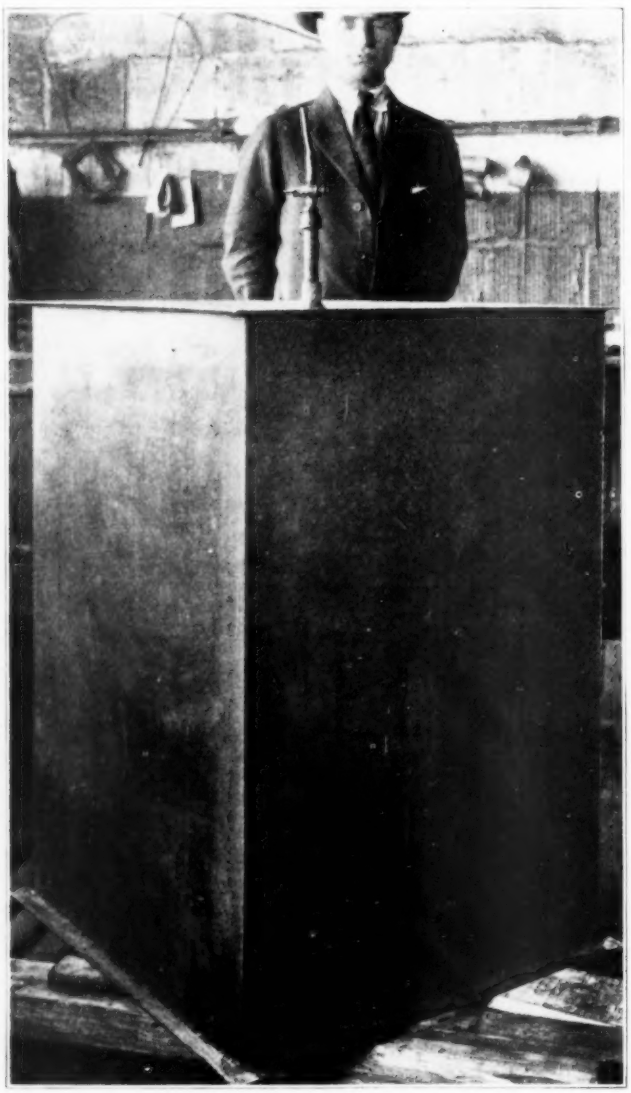
By Otis Allen Kenyon.

For the purpose of investigating the feasibility of arc welding gasoline tanks of $\frac{1}{32}$" metal, the following test was made.

The tank was designed in such a way, as to involve a maximum amount of welding and of such shape, as to subject the welding to bending stresses. In Fig. 1, we show the design of the tank. It consisted of 6 pieces of plate, the 4 sides being 2x3 ft. and the top and bottom 26x26 in., leaving an inch overhang all around.

The weld was made of one fillet in each case. The operation taking place as follows:

Two plates were assembled in a clamping jig, as shown in Fig. 2, tacked at intervals of about 8 in., then the weld started at one side and continued straight across.



Tank Ready for Test.

In the same way all four sides were welded at the edges, then the open ended box thus formed, was set on one of the end plates and held in position by loading it. The two parts were tacked as before and a single fillet weld run from corner to corner around the tank, then the tank was reversed and the other end welded on in the same manner. The entire welding operation was done with $\frac{3}{32}$" welding pencils, having approximately the following composition.

Carbon	0.18
Manganese	0.45
Phosphorous	0.045
Sulphur	0.045
Silicon	0.015

The current was set at 75-amp. and the length of the arc was 15-volts. A constant-current closed-circuit generator supplied the energy.

In Fig. 3, we show the completed tank ready for test. The pipe connection in the top was also welded in.

It was planned to make the test with 20-lb. per sq. in. pressure. However, doubt was expressed that a tank of this size and strength would be able to withstand that much pressure on account of the distortion. However, the pressure was gradually increased until full line pressure was used, namely; 96 lb. per sq. in. and still no leak was caused, although the tank was distorted as shown in Fig. 4. This pressure represents a total load of 83,000 lb. on a side, or 2300 lb. per lineal inch of side seam.

Tank Under 96-lb. per Square Inch Pressure.

Examination of this illustration, will show that the weld was called upon to withstand bending action in all directions. The welds in the corner side seams, for instance, were spread by the action of the pressure, and in addition to this, the welding line was made to execute a double bend, on account of the stiffness at the corners.

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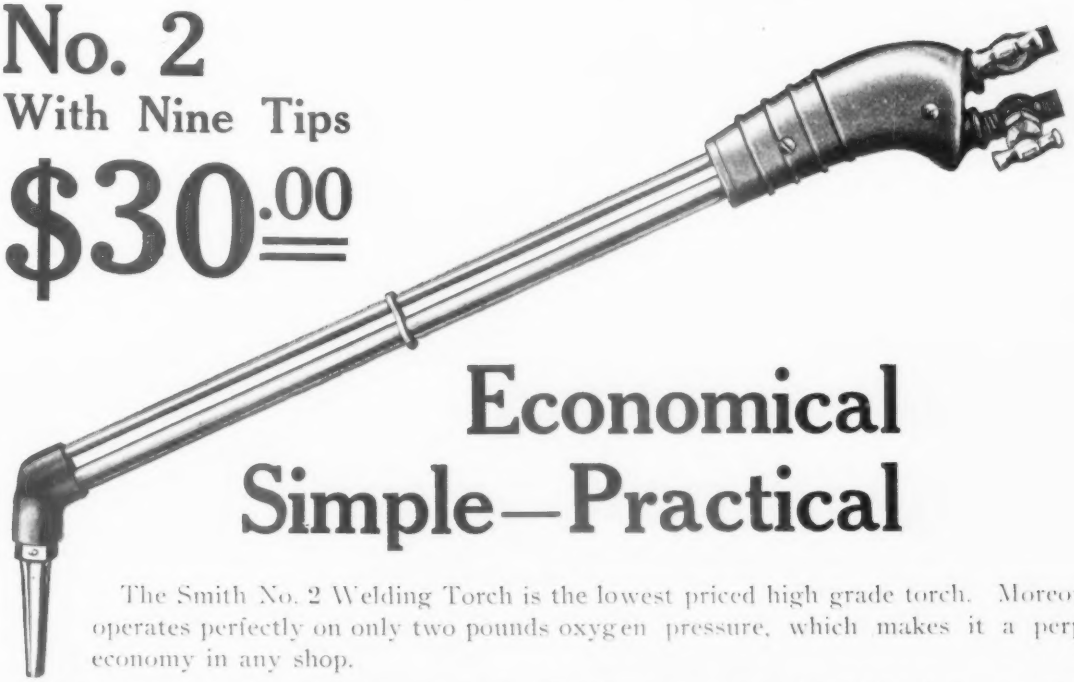

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This torch is simple and easy to operate. The low pressure under which it operates gives it a soft flame that will not blow the metal. It will not flash back.

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IS WELDING A TRADE?

Why the Welding Industry Should Be Organized as a Trade by Itself and How in the Writer's Opinion it Should Be done

By Nels Johnson.

Welders from different parts of the country have from time to time voiced their opinion in *The Welding Engineer* about the classification of the welders, and it appears that the sentiment in general is that welding is without any question a trade, as much as any other class of work, and should be so recognized.

The question of organizing the trade and demanding recognition has not been pressed very hard as yet, but now that the matter is under discussion let us follow it up. Some one will have to do it. We will not let the matter drop, but press on until we gain our point.

Any one engaged in a useful occupation is and should be proud of his trade. A good mechanic always tries to obtain the best possible results. He does not feel satisfied if the job for any reason is defective. To some men, following a certain class of work, the working problems come very easy. Some mechanics will handle the work easy and skillfully, while others work hard and accomplish nothing. Thus we often hear the remark: "You may learn to play an instrument, but you must be born a musician." It is true.

The success of any undertaking depends greatly upon the interest we take in the work, and the welding is no exception to this rule.

There are hundreds, yes, perhaps thousands of mechanics from different trades who have taken up welding because they like the work and find it interesting. There are thousands of others who have followed no other occupation but welding. They are good welders, and have adopted that work as their trade.

Why then should not the welders trade be recognized as a trade? Why should the welders be compelled to belong to a half a dozen different organizations, if they choose to belong to any at all? Why should not the welders have an organization of their own, where they could come together and discuss the problems of their work, which no one else really takes interest in, and no one else understands?

Why should we not have a trade of our own, that we could be proud of, as we now are of the work we perform with the torch?

It is said the torch is only an improved tool. Let that be as it may, but it takes a good mechanic to get good results from that tool. There is enough to learn about that tool and the work that can be done by it to keep one busy awhile at least.

It is said that welding is learned in a very short time. Any one who is a little mechanically inclined will learn to do that work in no time. Sure! Any one can take a fiddle and manage to get some kind of noise out of it, and call it music. I myself could manage to empty a whole theater in a short time by playing on one. I have seen a lot of work done by these smart fellows. They may call it welding themselves, but, after a year's practice on different kinds of work, most will agree that they don't know it all yet.

If welding is a trade the present system is surely a very poor one, and it will create poor welders. I have heard, from demonstrators who traveled a good deal and met welders by the hundreds from different parts of the country that less than 25 per cent of all welders could be called good mechanics. Why? Because wherever the split-up system is practiced the men get no chance to become good welders. They may be fairly good on one class of work, but get lost should they be put on something different.

What we need is a system, a good system, and not one of jurisdictional disputes. We want the welding all to ourselves; we want to be free to develop this new trade of ours. I can see no other way to get this without organizing. Therefore, let us ORGANIZE.

First, we need a medium through which as many welders as possible can be reached. *The Welding Engineer* I think would be very appropriate. A suitable resolution should be written demanding that the recent order of the Director General of Railroads, Mr. McAdoo, be changed regarding Oxy-Acetylene, Electric and Thermit welding. And demanding, further, that the welding mentioned should be done by men following that trade. Suitable blanks for signatures should be mailed to subscribers of *The Welding Engineer* and all subscribers asked to get signatures, both from welders, railroad officials, if possible, and other employers of welders.

Thus, I believe, signatures of the thousands could be gathered. I do not believe it would work very successfully to start an organization upon a small scale somewhere. It would be better to take the matter right to headquarters. A copy of said resolution should, together with signatures, be sent to the War Labor Board at Washington, and also to the head officials of the American Federation of Labor, asking that steps be taken to organize the Welding Trade. I realize that this could not be done without considerable expense and a whole lot of work. Should *The Welding Engineer* agree to do the work I would suggest that all interested parties donate money to help cover the expense.

It appears to me that The Welding Companies throughout the country should give this matter their hearty co-operation. They will be benefited as much as the welders, and should lend a helping hand, both financially and otherwise.

Some concerns employing welders will no doubt oppose the measure, believing that if their men get organized they will demand higher wages, and thus hamper the industry. What difference does it make? If the railroad shops that are now well organized pay a certain wage the smaller contract shops must pay the same, if they wish to keep good mechanics.

This is the age of organizations. All big business is organized; nearly all labor is organized. The right to organize is not only upheld, but encouraged. Why not then deal with a welder's organization, recognized by the American Federation of Labor, instead of having the welders belong to many different organizations?

The time to organize was never better than at present. I do not believe in making an independent organization. We wish to work in harmony with other organizations and be part of the same great labor body, the American Federation of Labor.

The head of the American Federation of Labor and the members of the War Labor Board, partly composed of labor leaders, are all broadminded and intelligent men. I am of the opinion that if the proposition is properly laid before these gentlemen they will look into the matter and give a decision favorable to our honest and just demands.

In conclusion I wish to suggest that *The Welding Engineer* take this matter up, or at least state if it is willing to do so if requested by a certain number of welders. I knew of no other medium through which this matter could be worked as effectively as through *The Welding Engineer*.

Editor's Note—The Welding Engineer is a free and independent paper, published for and in the interest of the entire industry. The interests of our readers are our interests. Welders must prosper, the trade at large must thrive, or we perish. We have no intentions of becoming involved in labor troubles or union fights, but The Welding Engineer would be very glad to be the medium through which a fair, decent protest is presented to the Railroad Commission, and which concerns the recognition of the art of welding as a trade in itself. In fact, the Editor of The Welding Engineer would be glad to hear from the trade on the subject.

Mackenzie.

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December 11, 1918.

Mr. L. B. Mackenzie
608 South Dearborn Street
Chicago.

Dear Mr. Mackenzie:

We have cabled to our Paris correspondent $1200. for the account of the FRENCH WELDERS' CHILDREN'S CHRISTMAS FUND. This cable represents the amount of subscriptions to this fund made by the Acetylene interests in Chicago.

Assuring you of our pleasure of being of service to you, we are

Yours very truly,

RWR. Assistant Cashier

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Universal Oxygen Co., Sheboygan, Wis	5.00
Walker, J. N., Prest-o-Lite Co	2.00
Welding Engineer, The, Chicago	25.00
A Friend	1.00
Total	$1,975.00

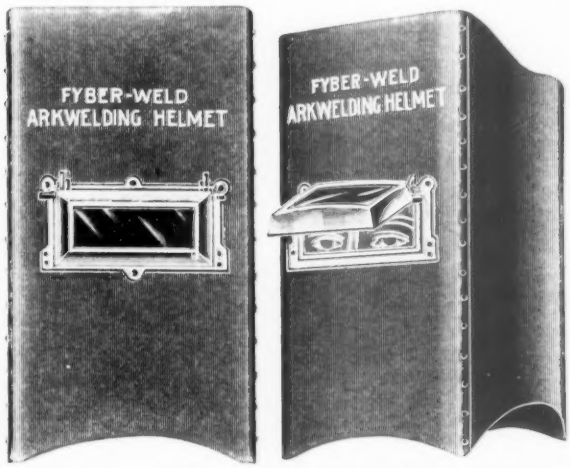
*Sent direct to France

A NEW ARC WELDING HELMET

A new helmet for welders, intended principally for arc-welders, but equally suitable for oxy-acetylene welders, has been perfected and placed on the market by the Chicago Eye Shield Co. The outstanding feature of this new helmet shown in the illustration (left). This makes it unof being a burden borne by the head.

Another feature of this helmet is the amber glass (or any other color preferred) which is behind the open door of the helmet is that it rests on the shoulders of the welder, instead necessary for the welder to wear an extra pair of spectacles, which he needs at times and which some manufacturers employing welders insist upon.

When the job is ready the welder drops the door of the helmet shown in the illustration—left. This makes it unwith a stationary front it can be supplied. The Chicago Eye Shield Co. have made a study of the proper colored lenses for welders, and a glass of any proper color can be supplied in any of their many eye-safety devices. In their large new plant at Van Buren, Ark., a new deep tone of glass is being manufactured as well as known "essentialite" which, with a white cover glass in front of it, gives the welder absolute protection and under the spectrum, shows that he has a



better and a more safe light than with the three or four panes of glass formerly used. These helmets range in price from $10.00 to $15.00 each.

Another new product of this company is a hand shield, which is being sold in large quantities.

OXY-ACETYLENE WELDING AND CUTTING IN THE FORGE SHOP.

By Curtis M. Thomas.

Prior to the adoption of oxy-acetylene welding in the drop forge shops, there was an enormous waste of material and profits, the main cause being defective forgings, many forgings not being filled on account of the raw stock being cut too small, etc., others having cold shuts because of the hammer men not exercising enough care when striking out the forging. Forgings of this kind were consigned to the scrap heap, which in a short time amounted to a large sum.

A large drop forging company in Detroit, Mich., seeing this waste, took steps to prevent it. They adopted the oxy-acetylene process, and have had great success, for instead of throwing defective forgings (unless defect is too great) on the scrap heap they are sent to the welding department where within a few minutes or hours (according to defect) they are salvaged. Large forgings weighing as much as 400 lbs. were formerly scrapped because of a small cold shut or a small place not being filled.

After a forging is welded the weld is hammered while still at a high heat—this gives the weld very nearly the same structure as the other part of the forging. It is then filed or ground, as conditions demand, and then put in a pickling bath, after which in many cases the weld cannot be detected. Some forgings are welded and then restruck under the dies. Care must be exercised in this as any loose particles of metal clinging to the outside of the weld will be driven into the forging, leaving a cold shut or afterwards falling out, leaving an impression which would have to be re-welded.

In welding crankshaft forgings the same kind of steel is used as the shaft is made of. After the weld is made it is hammered while at a high heat. This gives it a fine structure and is as serviceable as if it had been perfectly forged. When heat treaded the Scleroscope or Burnell test find it the same, and when machined very little difference is noticed by the use of a microscope. A man with little experience should not attempt to weld bearings or pins of a crank shaft because if it is not perfectly welded small pin holes in the weld will cause trouble when machined.

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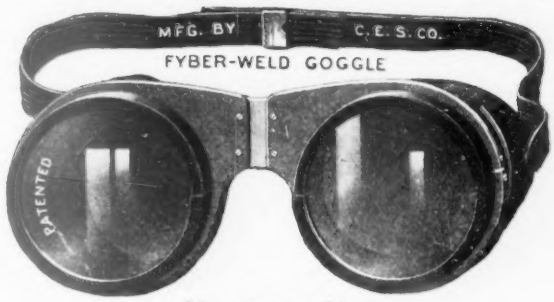

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There is a constant flow of broken or badly worn machine and hammer parts to the welding department. The welding of these parts means a great saving and keeps up production. A small hammer part may break and thus stop the production of this hammer. Now, instead of having this hammer idle while a new piece is made, the part is welded and in a short time the hammer is at work again.

Fig. 2 shows a hammer cylinder which had the valve casing broken at the point indicated by the chalk marks. A brick furnace was built around the casing, filled with charcoal and when heated to a red heat the welding was begun which required about 30 minutes. It was then left to cool and this hammer was idle for only one day.

Fig. 3 shows a steam pump of which one of the cylinders was cracked. Crack is indicated by chalk mark. The 4 cylinders, base and chambers were cast in one, a brick furnace was built around the cracked cylinder after it was V-ed out, and a charcoal fire built around it. When it was hot enough, welding was started, which required about one hour.

Welding of Forging Dies.

The writer has had a lot of experience in the welding of forging dies—such as building up edgers and places where the die sinkers had made mistakes and cut the impressions too deep, etc., also where impressions were worn.

Norway iron is used in most cases; in some cases we use higher carbon steel as a filler, but very seldom. When this was first contemplated, it was the belief of the die sinkers and forge men that the metal would be too soft and would squash when subjected to blows of the hammers, but such is not the case. We have some of the largest hammers in the state, and welded dies are standing this severe test fine. Welded portions show a hardness of 40 when tested by the Sclero-scope.

One thing to guard against is having an inexperienced welder do the job. The tendency of such is to begin welding before the die is hot enough, therefore not getting a sound weld, merely covering the spot to be welded.

Dies are nearly all made of nickle steel, as this steel is quicker in solidifying and therefore if care is not exercised the weld will contain many flaws.

Fig. 1 shows a die used in forging 155 M M gun limber axles, on which the writer built up an edger. The part added is 7x8x1½ inches. If this had not been built up, the whole die would have had to have been cut down 1½ inches or a plug dovetailed in, which in this case would not have been very satisfactory. This same set of dies was later welded. A place in the impression 5x4x2½ inches was built up in both dies. These dies are used in a 10,000 lb. hammer.

Oxy-Acetylene Cutting a Time Saver.

Before oxy-acetylene cutting was brought into use, trimmer shoes had to be cut out with the drill press. This was a long and tedious job as holes, one adjacent to the other, had to be drilled along the line of the form. This left the walls very rough and they had to be milled afterward.

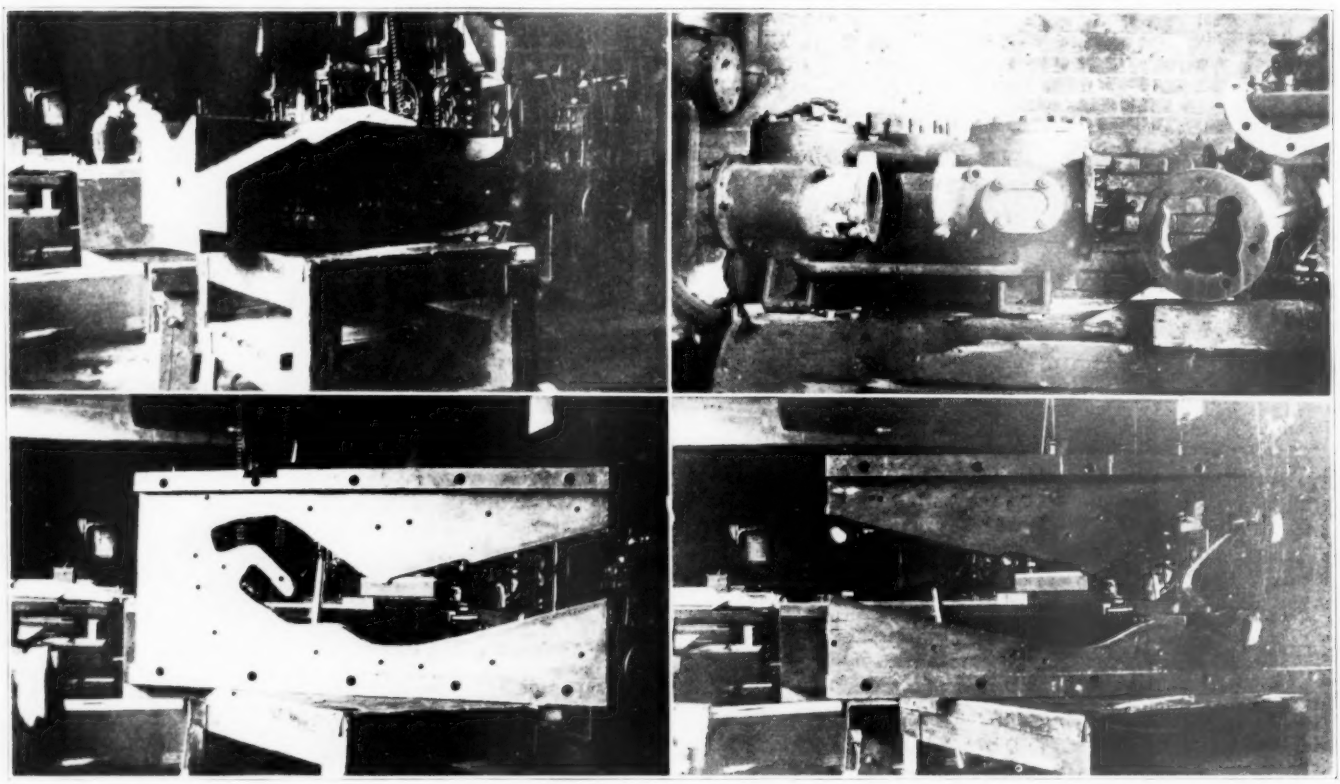
At the present time all trimmer shoes are cut out by oxy-acetylene process. Figs. 4 and 5 show trimmer shoes cut by the writer. The work required about fifteen or twenty minutes apiece, where, by the old method, it would have required about two days apiece. These are 155 M M gun limber axles trimmer shoes.

Cutting of raw stock is another great item. Stock too big to be cut with the shears is cut with the blowpipe.

Fig. 6 shows a cutter, scoring 5x6 inch billets, these being too short to be cut on the shear. They are scored to a depth of one-half inch, then broken under a steam hammer or a bulldozer.

Large die blocks are also cut with the blowpipe. Care should be taken in cutting die blocks in cold weather as they are high in carbon and they should first be warmed as the

(Continued on Page 48.)



Top at Left, Fig. 1. At Right, Fig. 3. Bottom at Left, Fig. 4, Right, Fig. 5.

APPARATUS INDICATING *the* FLOW *of* GASES

*A New Instrument Which Accurately Records the Gas Used by the Welder**

By Arthur W. Dohmen

IN the August issue of *The Welding Engineer* a welding concern inquired "if there is such a thing as an individual meter to attach to an oxygen and acetylene line to determine the costs of gases being used on an operation of any kind."

The inquirer explained the reasons for wanting individual meters thus:

"Our welding department has been equipped to manufacture our own acetylene and oxygen, so all welders work from a service line with individual reducing valves for each workman, but at the present we are using the commercial oxygen cylinders which are attached to a cylinder manifold in the gas manufacturing plant, supplying the welders through the service line.

Our idea of the individual meter is to get an accurate statement of the gases each welder uses on a specific operation, which will also give us the difference in gases used by a number of welders working on like operations."

We could not give a more concise description of the gap that exists in the up-to-date welding and cutting equipment. It is quite remarkable that such an instrument heretofore had not been accessible to the manufacturers and users of welding and cutting equipments; its lack is a decided handicap.

With rapid strides we are developing new home industries. We are rushing through strenuous times whose slogan, "Economy and Efficiency," moulds our progress.

The autogenous welding and cutting industry has grown remarkably; however, those who know the magnitude of the welding and cutting field are aware that we have only begun to realize the great future that spreads before us in this line. A shortage of cylinders, gases, etc., exists; it was caused by the enormous demand made upon all industries by the world war. It must be expected that the welding and cutting business will not suffer on account of the changed international situation; in fact, the period of reconstruction should give further impetus to its growth as welding and cutting is far more essential for shipbuilding, structural work, etc., than it is for war material proper. For this reason we should not relax in our efforts to obtain the utmost efficiency and economy to meet the conditions which we shall be confronted with.

The welder and cutter has to give special attention to cost and quality in his work. To accomplish this he needs an instrument that not only "gauges" but indicates the actual rate of gas flow. The lack of such an instrument has been felt more than ever before during the past few years of rapid expansion of the industries, and simultaneous shortage of skilled labor, and material.

The demands of the welding and cutting shop are of such a complex nature that it was a difficult task to develop an instrument which fully met the requirements, i. e.:

1. The instrument had to be strong, simple and reliable.
2. It should indicate the actual or relative flow on a practical and handy calibration.
3. It should indicate the flow of gases under a static pressure, from a few pounds per square inch to 200 pounds per square inch.
4. Convenient application.
5. Foolproofness.
6. Cost to be within the reach of even the small shop.

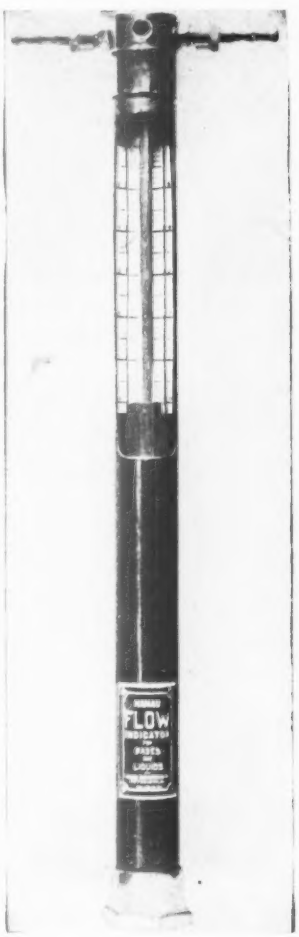


Fig. 1.

The writer had an opportunity to test such an instrument; the results he obtained are both interesting and valuable.

The instrument responds to differential pressure. The difference in pressure on both sides of an orifice which causes flow, acts upon a float immersed in a liquid. The float is of a special bell type. It magnifies the height of the differential pressure to cover a desired range. The rate of flow is indicated by the position of the float and is read on a suitably calibrated scale. Two standard nipples are provided for the customary hose connections.

The instrument used for the tests has a 6 inch scale, is 19 inches in length and 1½ inches in diameter. (See Fig. 1.)

The great advantage of using such an apparatus is apparent. The experienced torch operator soon finds the most efficient mixture of gases for a certain class of work by simply noting the position of the float. Thus the same flame can be obtained at any time by anyone by merely re-establishing the same float positions.

We all know that the main difficulty in handling a torch is the adjustment of the mixture. The present method of merely regulating the pressure is by no means a criterion for the mixture itself, if it were, no further adjustment of the torch valves should be necessary. The only excuse for the present method of regulating the flame is that we had none better at our disposal. If for some reason or another some

The instrument referred to is being brought on the market as the "Hanau Flow Indicator for Liquids and Gases."

obstruction should enter the line, torch or tip, the originally prescribed pressure ceases to be correct, and the torch hand must rectify the deviation by adjusting the valves at the torch. A flame of different mixture may be expected, while a flame of different intensity must result. With a Flow Indicator the intensity of the flame and the mixture of the gases is fully under control by first, reading the quantity, and second, by observing the ratio of the quantities of both gases.

Should the operator have difficulty in obtaining the proper flame with the table of flow of gas at his disposal, then he knows immediately "there is something wrong," which of course must be remedied. So far we were absolutely and solely dependent upon the "visual judgment" of the operator

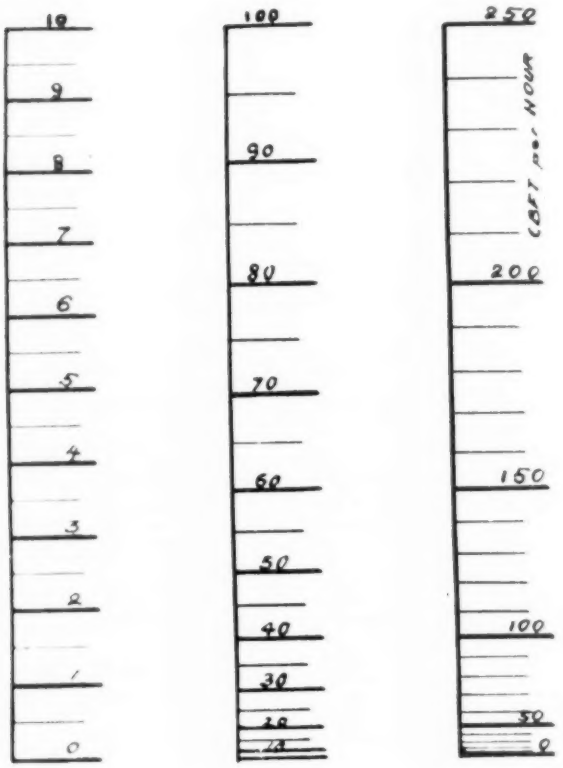


Fig. 2.

which, like all "good judgment" varies with the conception and whim of the operator.

To illustrate the usefulness and possibilities of the instrument, let us enumerate some practical applications. A welder wishes to find the most efficient tip to weld plates, say ranging from ½" to 1" in thickness. He has the choice between different makes and sizes of torches, and possibly of different gases. All these problems are most accurately solved with the aid of the Flow Indicator by merely interposing the indicator in the line, reading the calibration and computing the cost. Where different pressures are applied the readings are reduced to a common basis.

By comparing the results with those of the old method no doubt of the usefulness of a Flow Indicator remains. Once the data are on hand they are tabulated to suit shop conditions. The final result is that the foreman can supervise and check the work of an entire crew most efficiently and conveniently, and he is relieved, to a great extent, in estimating the work. Justice is also done to the record of the operator, who may improve his work because he is able to check his own doings.

The Flow Indicator is used wherever the indication of the rate of flow of gases or non-viscous fluids is desired. The instrument shown in the illustration is designed to suit the welding and cutting shop.

The picture shows an ordinary inch calibration which is an "arbitrary" one, but as far as it concerns the torch operator, it fully suffices. More appropriate is the "relative scale" which has a calibration giving in per cent the volume at the pressure for which the instrument is calibrated. An "absolute scale" should preferably be used, but at present is only recommendable where one constant working pressure is maintained throughout the shop.

The "absolute scale" is calibrated in cubic feet of saturated gas per hour reduced to 60 degrees F. and atmospheric pressure. The three calibrations are schemetically shown in Fig. 2.

At present we regulate the gauge pressure to produce the intended flow of gas to the torch; the flow indicator eliminates the necessity of a variation of pressure in the feeding line, because the operator automatically throttles the pressure at the torch valves when he uses the flow indicator for his guidance.

For the time being the "relative scale" is the most convenient for general shop work because of the different working pressures that are prescribed for the different tips.

In conclusion the result of a welding test is given. The consumption of oxygen for a welding operation was determined.

One and the same torch was operated by two different operators on like work.

With the aid of the Flow Indicator it was determined that operator A consumed oxygen at a rate of 41 cu. ft. per hour and operator B at a rate of 46 cu. ft. per hour. Operator A completed his work in 18 minutes and operator B in 17 minutes, so that the total oxygen consumption for one piece figures in ratio 100 to 106, which is a difference of 6 per cent in oxygen consumption. It could have been saved if the operator had used an adequate control.

It is realized that the application of the Flow Indicator by no means is confined to the welding and cutting art, and that it will find a great field in all those industries which are handling gases and liquids in processes, etc., such as are presented in the chemical and general gas industries.

The use of the Flow Indicator should not only accomplish a saving in gas, but should also lead to improvement in cutting and welding and secure better and more uniform work.

A NEW WELDING MANUAL.

As the November issue of *The Welding Engineer* was going to press we received an advance proof of a new book on the subject of oxy-acetylene welding and cutting, the title being "Oxwelding & Cutting," published by the Oxweld Acetylene Co. This book is in no sense of the word a catalog, but is exactly what its name would imply, a manual. It consists of more than 125 pages, only a few of which are devoted to descriptions of Oxweld equipment. The author has gone about his work very thoroughly and has not only attacked the preliminary subjects in a very methodical and thorough manner, but he has also adopted a very illuminating method of driving his points home. He has taken, for instance, 60 welding problems, ranging from the common "garden variety" up to the more advanced jobs, and given an illustrated and thorough answer to each and every one.

The text is good and the illustrations are the kind we believe in—workable, line drawings, the kind you can prop up on the bench and use every day. We don't know whether the Oxweld folks sell it or give it away, but it's worth whatever they ask for it.

TEMPERATURE OF METALS.

Editor: When I am preheating an aluminum crank case I determine the proper temperature by rubbing the case with common wire solder. I find that when the solder melts the case is at the right heat. I never have trouble with them.

U. S. Hubbell.

Welders Attention!

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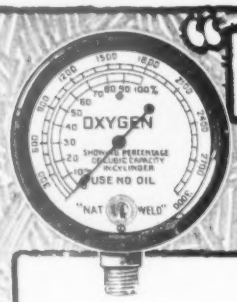

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Minneapolis, Minn., U. S. A.

intense heat of cutting may crack them. The writer had a 15x18x45 inch block crack which made half of the block useless.

AUTOMOBILE SPRINGS.

Editor: I can weld auto springs successfully, using old bed springs as filler rods. In testing the auto springs after welding I find they break very close to the weld, on each side. This is because the metal has become annealed dur-

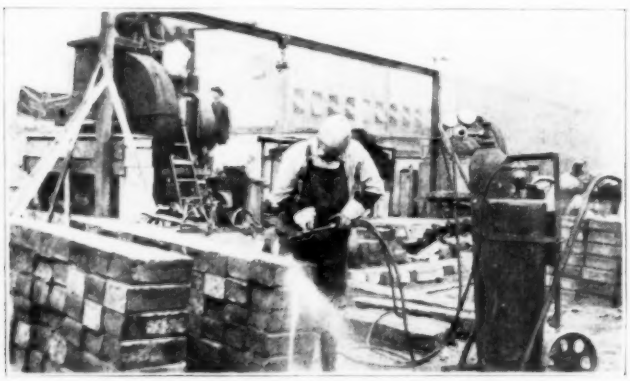


Fig. 6.

ing welding. How can I overcome this? Can you tell me how to temper a spring after welding?

Sid Kepford.

Answer: I have never known a welding shop that met with any great success in welding automobile springs. Of

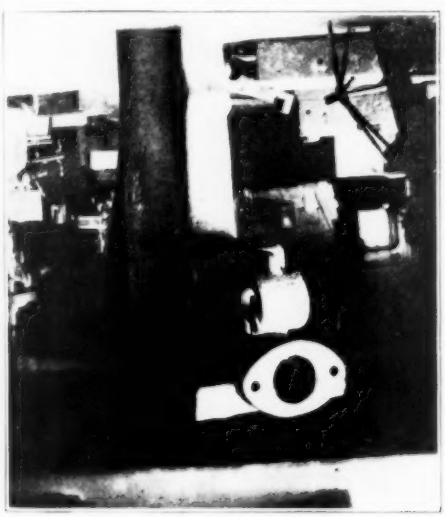


Fig. 1.

course, it makes some difference where the break is. Oftentimes, a temporary job can be done, which will enable a man to drive his car home. However, we do not recommend that welding shops solicit this class of work.

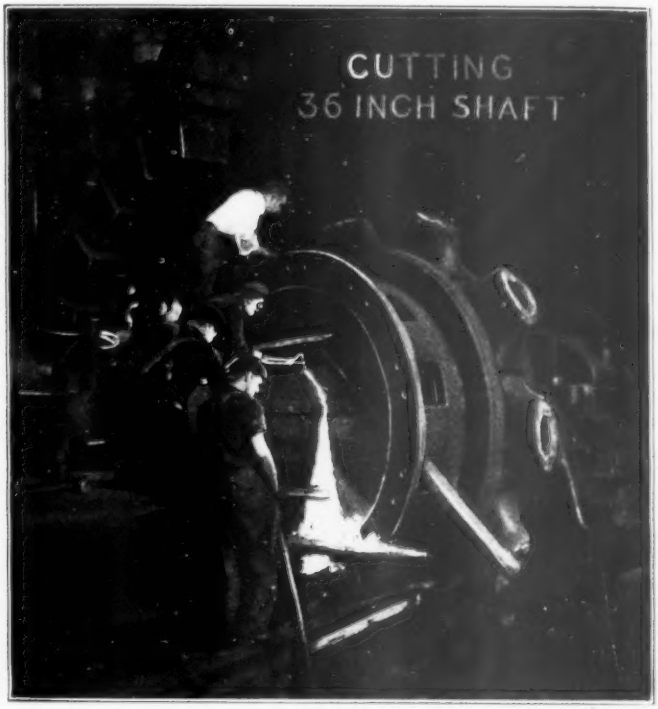
It is practically impossible, without very expensive facilities, to restore the temper to the springs, and the break will generally occur just as you describe, no matter what filler rod you use.

Relative to the question of tempering metals, I would advise you to write to the D. Van Ostrand Company, New York City, and the Industrial Press, 140 Lafayette St., New York City., and ask them to send you some information relative to books on tempering metals. It takes a book to tell the story. Editor.

CUTTING A 36-INCH SHAFT.

A remarkable series of heavy shaft cutting has lately been performed in a large power house for the quick removing of steam engines to make room for turbine generator sets.

There were several 36-inch shafts to be cut, and although they had an inner hole of 10 inches, the cutting had first to go through more than 26 inches of solid steel before reaching the inside hole. The picture shows how easy it is to perform such exceptional cuts with the right apparatus.



The cutting was done with a "Bulldog" cutting equipment of the General Welding & Equipment Company, Boston, Mass.

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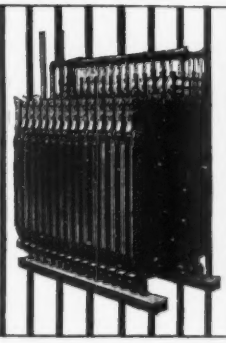

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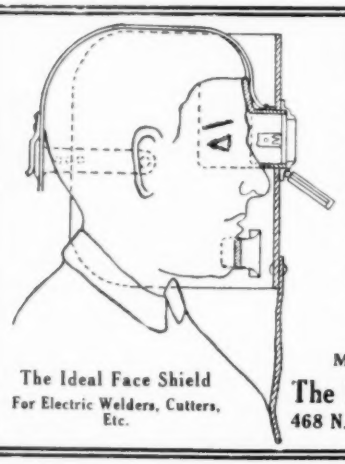

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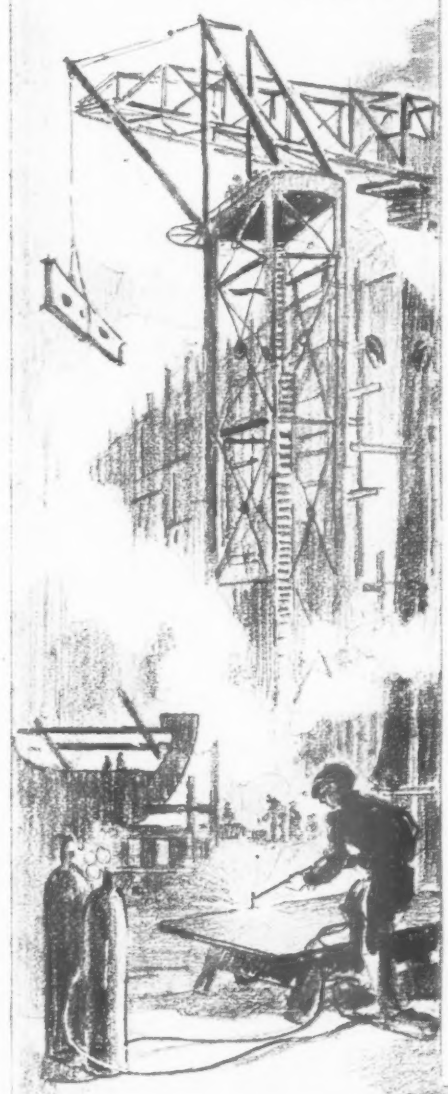

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